SIEMENS

UROSKOP D3

SP

Start-up Instructions

with POLYDOROS SX
and
FLUOROSPOT H with Supervision

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Safety information

CAUTION

When performing service work and tests, please adhere to the product-specific safety information contained in the document, as well as the general safety information contained in Register 2 of the TI binder.

Tests and adjustments performed with radiation ON are identified with the radiation warning symbol ☢. Radiation protection must be worn during these types of adjustments.

General information and information on documentation

These instructions contain the checks necessary for system startup.The sequence in which they are given must be maintained.

The unit movements necessary for these procedures must be carried out very **carefully** to avoid damaging the equipment in the event of a malfunction.

Since the unit has been adjusted completely at the factory, only the functioning and factory settings (accuracy of tolerance) are checked; the unit must be adapted to on-site requirements, if necessary.

If any mechanical or electrical malfunctions occur or if tolerances are exceeded (damages caused by transport etc.), perform service work and adjustments according to adjustment instructions RLL5-310.071.01... or the service instructions for the corresponding components.

Measurement results marked” ⩾ ” must be entered in the UROSKOP test certificate.

For the acceptance test which is required in Germany in accordance with §16 of the Röntgenverordnung (x-ray ordinance) and for the acceptance test required in the USA, the following checks have already been performed in the factory test area and documented in the test certificate:

- Visual check of the filter values.
- Check of the SID display.
- Brightness of the light localizer.
- Coincidence of light field and radiation field.
- Accuracy of the manual format collimation.
- Coincidence of radiation field and film center.
- Accuracy of positive beam limitation (PBL) system for cassette formats.
- Fluoroscopic field limitation.
- Centering of the radiation field and monitor image center.
- Function check of the Iontomat measurement fields.
- Unit attenuation factor.
- Check of the tomographic device.

NOTICE **Enter the measurement values and the additional values determined during system start-up from the test certificate into the acceptance certificate (Germany) or in the acceptance test certificate (USA).**

Preliminary information on image quality test

Purpose:

- The image quality test provides objective data as a basis for image quality and facilitates system start-up.
- The test certificate is valid for system acceptance and for future service and maintenance work.

Sequence of work:

- Follow the sequence of measurements and checks exactly as describes in order to ensure correct measurements.
- Enter the results of each measurement into the test certificates.
- Compare the measured values with the values indicated in the list of nominal values.
- If the limit values are exceeded, you must determine the cause and correct the error or the erroneous setting before continuing the test. Otherwise the measurements that follow may be incorrect.

Requirements for start-up

- The system must be cabled completely.
- Switch on high voltage only if radiation is necessary.

Required Documents

• Operating instructions	UROSKOP D3	RL5-340.208.01...	
• Wiring diagram	UROSKOP D3	G5403	
• Wiring diagram	POLYDOROS SX	X2075	
• Service software operation	UROSKOP D3	RLL5-310.113.02...	Logbook, Reg. 10
• Setting Instructions	POLYDOROS SX	RX63-050.032.02...	
• System configuration	POLYDOROS SX	RX63-050.034.06...	
• IQ Test certificate		RXD0-000.037.01...	Logbook, Reg. 9
• Test certificate	UROSKOP D3	RLL5-310.035.01...	Logbook, Reg.3
• Test certificate	POLYDOROS SX	X2075	Logbook, Reg. 4

Required measuring instruments

• 3-Phase field rotation meter, electronic	97 02 713 Y7933
• Internal line impedance meter	84 28 104 RE999
• Service PC	
• Oscilloscope > 50 MHz, e.g. Tektronix 2232 with delayed time base	97 02 234 Y3155
• Multimeter 8060 A (Fluke)	97 02 101 Y4290
• mAs meter	81 60 400 RE999
• Water level	28 69 436 RE999
• Set of Cu filters	44 06 120 RV090
• 17 µm Cu strips (included in the LOG book)	11 67 663 G5247
• cm scale	
• Tomographic cube with resolution test	44 06 054 RV 090
• Protective conductor meter	44 15 899 RV090
• 8x magnifying glass	44 14 850 RH090
• Precision radiation filter	99 00 598 XE999
• Centering cross or lead ruler	96 60 051 RE999 or 28 63 025 RE999
• Mavo monitor, direct ordering	97 02 432 Y0526
• Resolution test patterns, types 41	28 71 820 RE999
• Dynamic test case	37 90 156 X1963
• heart contour diaphragm	37 90 172 X1963
• Capillary test	37 90 180 X1963
• DSA displacement test (with DSA capillary test)	97 50 019 X1963 (only with DSA)
• Aperture plate for tomography	

CAUTION **Successful system start-up can only be ensured by using the above measurement instruments.**

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Protective measures

- Observe the protective measures described in Register 1 of the UROSKOP D Logbook.
- Prior to performing any service work on the generator, switch it off with the power **OFF** switch on D200.
- In order to deenergize all parts of the system, set the system switch to the **OFF** position.

CAUTION

With the generator switched off, line voltage is still present at transformer T1 and fuse panel D200 (refer to wiring diagram X2075-11).
After switching off the generator, approx. 600 V DC voltage are still present at the inverter; indicated by LEDs V8 and V9 on board D250 (see X2075-17).
Within approx. 1 1/2 minutes the voltage drops to 0 V; the LEDs go out at approx. 30 V.

- To prevent unintentional release of high voltage or radiation, set switch SS on D200 to **OFF** (no actuation of the inverters).
- Remove or insert boards only with the generator switched off. When doing so, observe the ESD guidelines (see TI 219, Info RA.5. RA0-000.012.19... on microfilm).
- On D211: switch S1 INT **OFF** (position 2).
- On D200: switch SS **OFF**.

Measuring the line voltage

- Remove fuses F1, F2 and F3 from the fuse board in M16 (generator).
- System contactor **ON**.
- Measure the line voltage.
  The voltage must correspond to the values indicated in the test certificate (logbook, Reg. 3).

Checking the on-site emergency shutdown button

- Actuate the emergency shutdown button installed by the customer. The entire system must be disconnected from the power line.
- System contactor **OFF**.

Checking the phase connection

- Check the correct phase connection of the power lines at M16.F1, F2, F3 (X2075-11), using the rotating field instrument:
- In M16, remove the cover from the fuse holders.
- Connect the3-phase field rotation meter to the lower connections of F1, F2, F3 (on the side of the power supply).
- System contactor **ON**.
- Perform the measurement.
- System contactor **OFF**.
- Disconnect the rotating field instrument.

Measuring the internal line impedance

- Measure the internal line impedance at M16. F1. F2. F3 (X2075-11):
  - Connect the internal line impedance meter between two phases of F1, F2, F3 (at the lower connections of the fuse holders).
  - System contactor **ON**.
  - Perform the measurement.
  - System contactor **OFF**.
- Record the measured values in the test certificate (logbook Reg. 3)
- Enter the measured values into the ”LINE PARAMETER” module of the system programming.

Important: In order to obtain the full generator power, the internal line impedance measured may not exceed the following values:

U_{line}	max. R_{line} withPOLYDOROS		measured
	SX 50	SX 80	
400 V	0.18 Ohm	0.12 Ohm	
440 V	0.20 Ohm	0.16 Ohm	
480 V	0.24 Ohm	0.20 Ohm	

Internal line impedances of > 250 mOhm reduce power. Refer to RX63-050.034.05.01.05... Configuration ”LINE PARAMETER”

- Reinsert fuses F1, F2 and F3.
- Reattach the cover.

Checking unacceptable ground connections

(connection between ⏚ and $0V_L$).

- Disconnect the connection lead between the upper and lower grounding bus (in the generator power cabinet).
- Using the multimeter, measure the resistance between ⏚ and $0V_L$:
  The measured resistance must be approx. > 50 kΩ.
- Reconnect the upper and the lower grounding bus.

Switching on the generator

- System contactor **ON**:
  - LED V26 (via fuse F11) must light up on fuse board D200.
    In case of an error, check the fuses in M16 and on D200 (X2075-11 and 12).
- Generator **ON**:
  - On fuse board D200, press key ⏻ and actuate button ⏼.
  - The LED's must light up as follows on the service panel of D211:

    The +5 V, ± 15 V, +24 V supply voltages are immediately present.

    If the +5 V voltage is missing, the generator is disabled.
    In this case, check the fuses on D200 (X2075-12). All LED's on D200 must light up.
  - Following connection of the intermediate circuit (activation of charging contactor and power contactor), LEDs V9 and V8 on board D250 must light up (X2075-17).

CAUTION	**A DC voltage > 500 V is applied to the intermediate circuit.**

  - Following correct initialization (after approx. 10 sec.), the following LEDs must light on the service panel of D211:

    (▣) (■) TU1 (after system programming)

    GEN-OK,+24 V, +15 V, -15 V, +5 V

    If no error has occurred, the 7-segment displays on D210 indicate "E000".

    In case of an error, the three-digit error code is displayed.
  - When programing the generator, "ALP" appears on the kV display of the control deck.
- Check the primary voltage for the supply voltages (X2075-12) at the coil connections of the GS contactor (X2075-11) in M16:
  230 V ± 10 % at 50 Hz
  250 V ± 10 % at 60 Hz
- Check the blocking:
  On D200: Generator **OFF**
  The generator cannot be switched on again from the deck.

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Checking the emergency stop switches

- System **ON**.
- Press the three system emergency stop switches consecutively:
  With the emergency stop switch pressed in,
  - error code ”U01” must appear in the *area dose product* display on the control console;
  - all system movements must be blocked.

Checking the control panel

- System **ON**.
- Select from 40 kV to the max. kV value on the kV control console by pressing the ± kV keys.
- Check the mAs display by pressing the ± mAs keys.

Function check of the anode starter

- Generator **ON** : On D95, display1→2→3
- Set release button S27 to preparation: the rotating anode boosts.
  Display 3→4→5

Let go of the release button S27 again: the rotating anode should brake.
Display 6→3

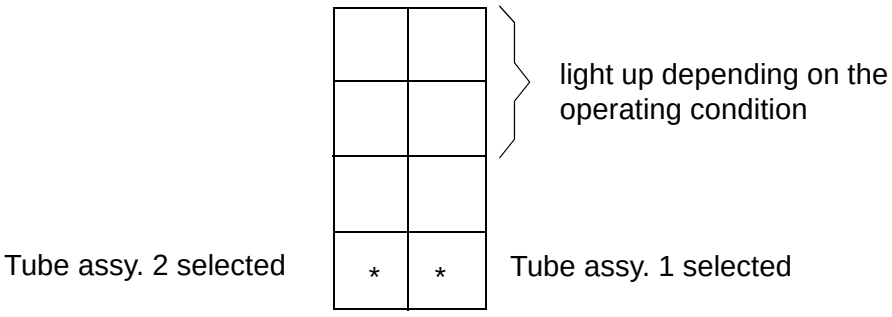
NOTICE	**The rotational speed must be checked with the tube assembly warmed up.**

Key to 7-segment display on board D95:

1=	Initialization	4=	Start-up
2=	Init-brakes	5=	Continued run
3=	Stand-by	6=	Brakes

If the ERROR message flashes, please refer to the information contained in the service software.

LED status display



Checking the fluoroscopic and exposure release circuit

Fluoroscopic circuit

- On board D200: SS switch **OFF**.
- On D211: FL switch **ON**.
- On D211: the following LED's must light up (X2075-23):

- TU1/TU2	TU 1/ TU 2 (acc. to selected workstation/tube assembly)
- ▣	small focus
- ■	large focus
- GEN-OK	Generator enable state
- DL	Fluoroscopy (FL) "on" (FL request)
- EXT-HW	Radiation enable state/safety circuit
- SWR	Start/inverter

NOTICE

SWR "start/inverter" is not illuminated as long as Kathotest (module J05) is programmed.
The "radiation indicator" lights up only with radiation ON.

- FL switch **OFF**
- SS switch **ON**

☢

- FL **ON**
- Measure the minimum and maximum kV and mA values and enter them into the generator certificate.

Exposure release circuit

With preparation:

- Set the release button S27 to preparation ↻.
- On D211, the following LEDs must light up:

- TU1/TU2	TU1/TU2 (acc. to selected workstation/tube assembly)
- ■ / ▣	(depending on focus selection)
- GEN-OK	Generator enable state
- ZB	ZB "ON" (exposure preparation (ZB) request)

With exposure release:

- Press the release button S27 all the way down.
- On D211, the following LED's must light up

- VH:	Exposure request to unit
- AR:	Exposure enable state from unit
- EXT-HW:	Radiation enable state/safety circuit

NOTICE	**SWR "start/inverter" is not illuminated as long as Kathotest (module J05) is programmed. The "radiation indicator" lights up only with radiation on.**

- Release radiation release button S27.

Controls and indicator lamps for radiation protection

At the customer's request, the following controls and indicators can be connected in the power cabinet according to the installation instructions RLL5-310.031.03..., page 4-6.

Door contact for radiation disable function

(e.g. at the door of the examination room)

- Check: When the door is open, radiation release must not be possible.

Indicator lamps for tube assembly selection

- Check: For fluoroscopy or exposure preparation, the respective indicator lamp associated with the tube assembly must light up.

Checking the kV/mA values

- System **OFF**.
- Connect oscilloscope to test points MP.kV_{act} and MP.mA_{act} on service board D211.
- System **ON**.
- SS switch **ON**.
- On the control console, select 77 kV, 32 mAs for ■ and ▣ focus respectively.

- Release one exposure in each case and check the kV/mA values of test points MP.kV_{act} and MP.mA_{act} with the oscilloscope.

- Enter the measured kV values into the test generator test certificate and compare them with the values recorded at the factory. They must be within the specified tolerances.

Checking the mAs values

- System **OFF**.
- On PC board D220 (over H1), remove the jumper from the mAs jacks.
- Connect the mAs meter to the mAs jacks.
- System **ON**.
- On the control console, select ■ , 77 kV, 80 mAs.

- Release an exposure and check the mAs value on the mAs meter.
- Enter the measured value into the generator test certificate.

Start-up of the automatic exposure control

Check the functions of the **IONTOMAT P** and **PLANI-IONTOMAT P** automatic exposure control systems according to the generator setting instructions RX63-050.032....

NOTICE	**The installation procedures described in the start-up instructions may be disregarded since both subassemblies have already been installed at the factory.**

NOTICE	**Since the UROSKOP has no selection for the film-screen keys H-D-U, identical values must be programmed for H-D-U in the IONTOMAT.**

Checking the reproducibility of the automatic exposure control

- Attach 2.1 mm Cu to the multileaf collimator.
- Set 77 kV,
  100%,
  large focus.

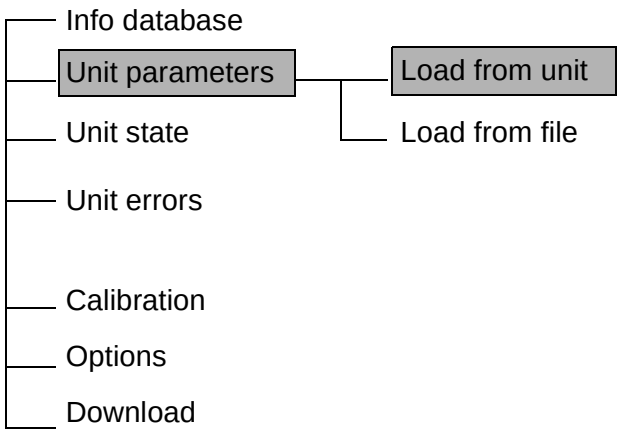
§16

- Select Iontomat.
- Release 5 exposures consecutively.
- Enter the measured dose values into the generator test certificate.

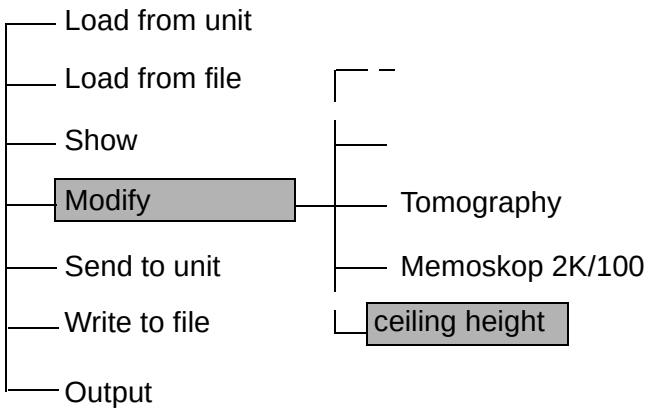
Preparation and limit values for tabletop lift

- Connect the service PC to connector X10 of board D1.
- System ⊙ (When the emergency stop switch is actuated,"U01" appears in the display).
- If necessary, release the emergency stop switch.
- Service PC ⊙.
- Start the service program
  (refer to the service software instructions RLL5-310.113.02...).

Main menu

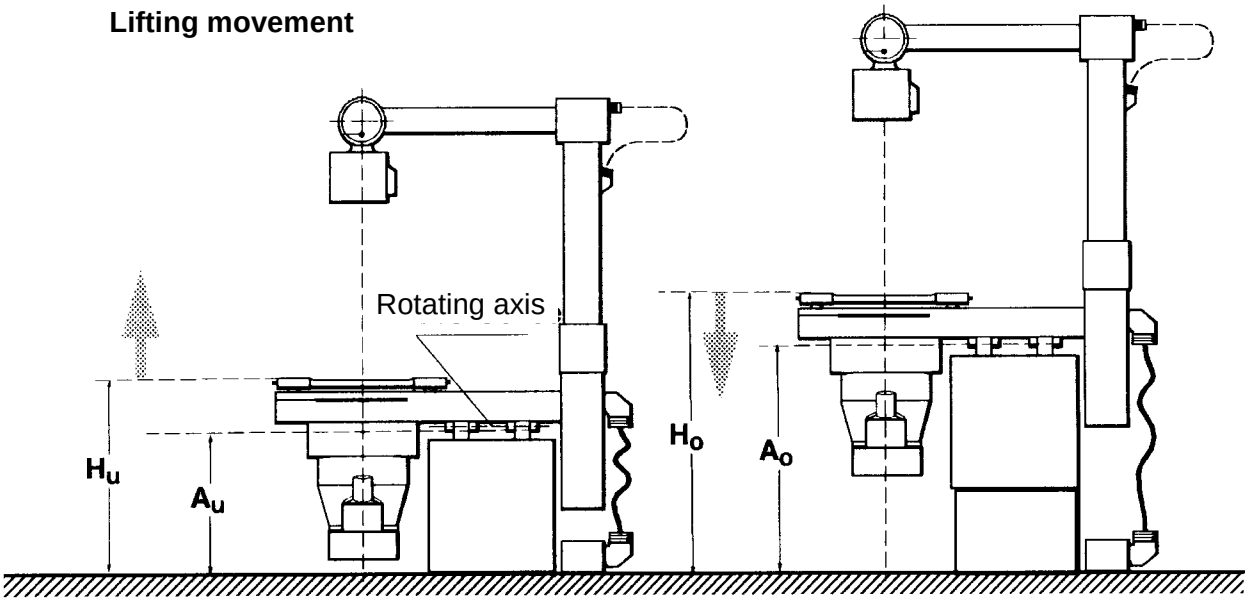


Unit parameters



- For ceiling height enter the actual room height available
- Press return.
- Press <F4>. Initial questions with **Y**es.

Lifting movement



Lifting movement

CAUTION	**Move into the end positions in gradual increments.**

- Tilt the unit into the 0° position.
- Successively move the unit into both end positions.
- Measure the distance between the floor or top surface of the installation plate and the top surface of the tabletop or rotating axis for both system positions:

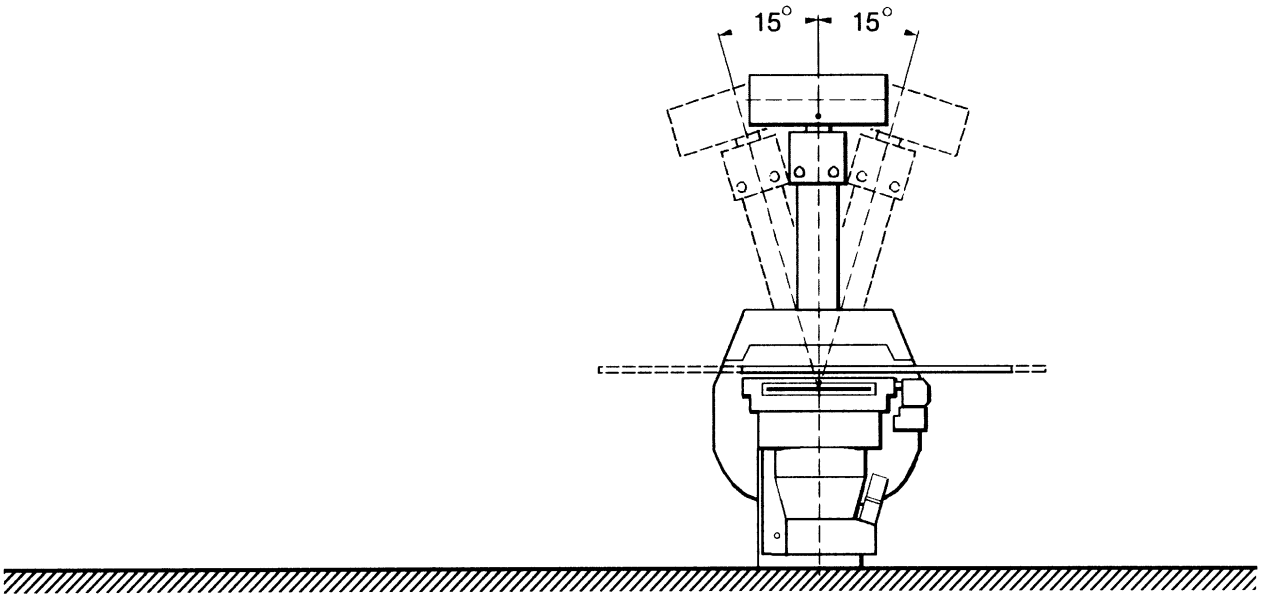
	Nominal distance between the floor or top surface of the installation plate and top surface of the tabletop		and rotating axis	
	H_u	H_o	A_u	A_o
	82 cm ± 5 mm	**128 cm** ± 5 mm	62 cm ± 5 mm	108 cm ± 5 mm
for I.I. 40	**86 cm** ± 5 mm	**128 cm** ± 5 mm	66 cm ± 5 mm	108 cm ± 5 mm

! minimum distance I.I. ⇔ floor: **4 cm !**

NOTICE	**H_o = 128 cm, possible only for room heights 2.60 m and above.**

Read the values displayed on the PC and compare them with the factory test values on the test certificate.

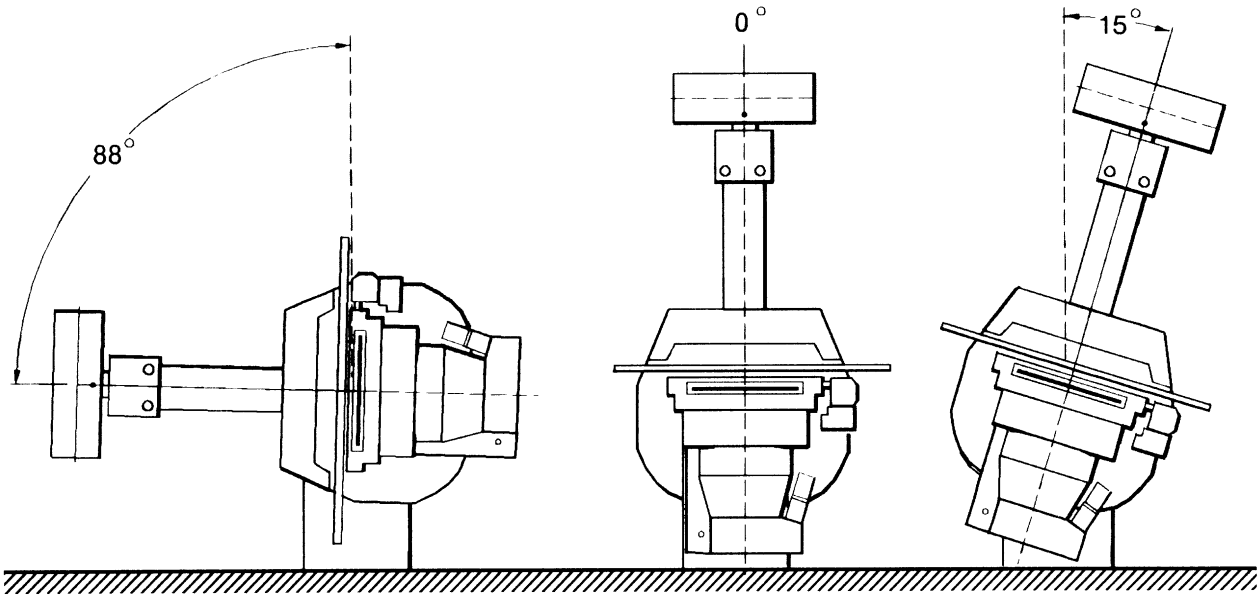
- Initial the comparison as confirmation.
  Lowest point: 62 cm to center of rotation with tilted table (+88°).
- **Correction:** UROSKOP D adjustment instructions



Oblique projection

CAUTION **Move into the end positions in gradual increments.**

- Swivel the tube assembly support arm in each case from the 0° position into **both** end positions, -15° and +15°.
  The 15° values must be indicated on the system control console; at the same time, the safety limit switch must not be pressed.
- Read the values displayed on the PC under menu item [*Unit state*], [**Current**] and compare them with the factory test values in the test certificate.
- Initial the comparison as confirmation.
- **Correction:** UROSKOP D adjustment instructions.



Tilting movement

Requirement: The installation plate must be level.

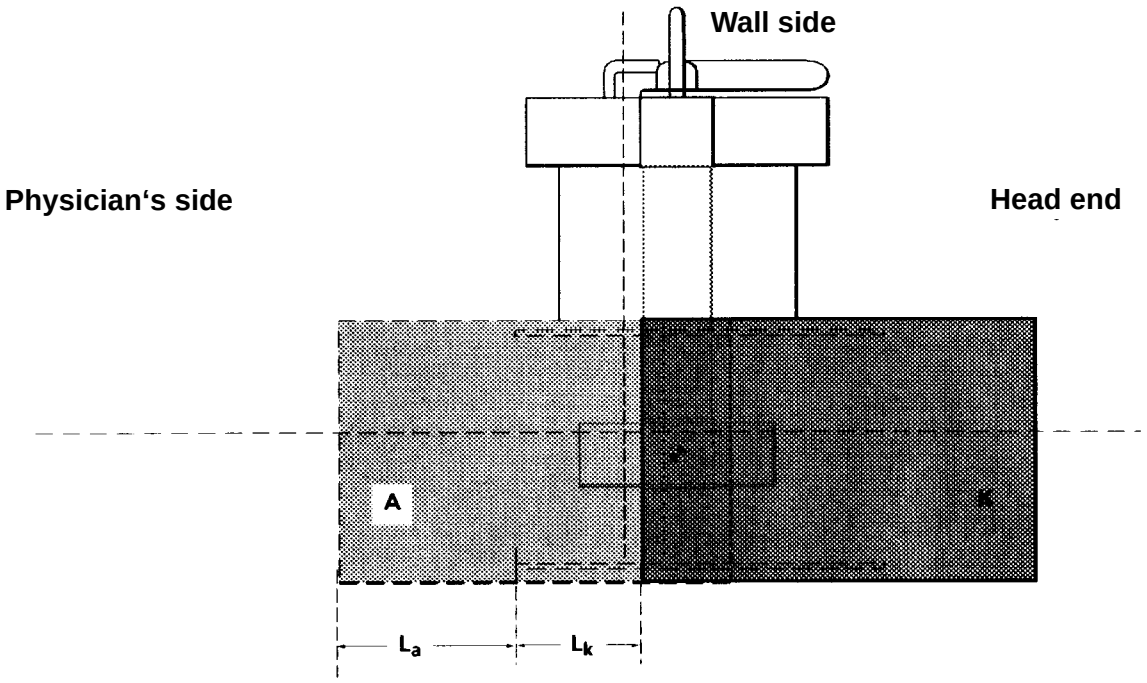
CAUTION	**Move into the end positions in gradual increments.**

- Tilt the unit in each case from **both** directions into the 0° position.
- Check the 0° position in each case with the precision water level after the automatic stop.

  Nominal: **0°** ± 0.3°
- Swivel from the 0° position into the +88° end position; the switching cam must not touch the limit switch.
- Check the +88° end position with the precision water level.

  Nominal: **88**° ± 0.5°
- Swivel from the +88° end position into the -15° end position; the switching cam must not touch the limit switch.
- Check the -15° end position with the precision water level.

  Nominal: **- 15°** ± 0.5°
- Read the values displayed on the PC and compare them with the factory test values in the test certificate.
- Initial the comparison as confirmation.
- **Correction:** UROSKOP D adjustment instructions.



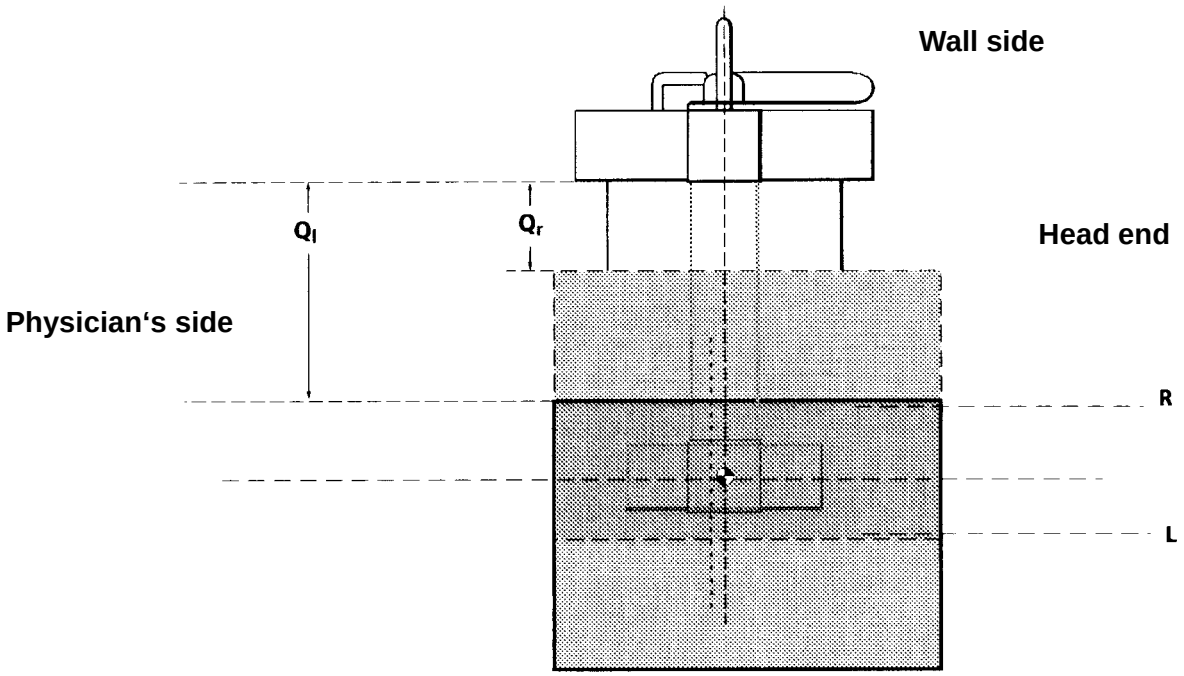
Longitudinal movement of the tabletop

CAUTION	**Move to the end positions in gradual increments.**

- Move the tabletop successively into end positions **A** and **K**.
- Measure the distance between the left tabletop edge and the left front of the front guide rail for both table positions.

Nominal: L_a **= 573 mm** ± 5 mm
L_k **= 573 mm** ± 5 mm

- Read off the values displayed on the PC and compare them with the factory test values of the test certificate.
- Initial the comparison as confirmation.
- **Correction:** UROSKOP D adjustment instructions.



Transverse movement of the tabletop

CAUTION	**Move to the end positions in gradual increments.**

- Tilt the unit into the 0° position.
- Move the transverse carriage of the tabletop successively into both end positions **R** and **L**.
- Measure the distance between the rear table edge and the front edge of the tube assembly support arm for both table positions:

Nominal: **Q_l = 55.5 cm,**
Q_t = 31.5 cm Total tolerance: 5 mm

- Initial the comparison as confirmation.
- **Correction:** UROSKOP D adjustment instructions.
- End the service program with <F10>.

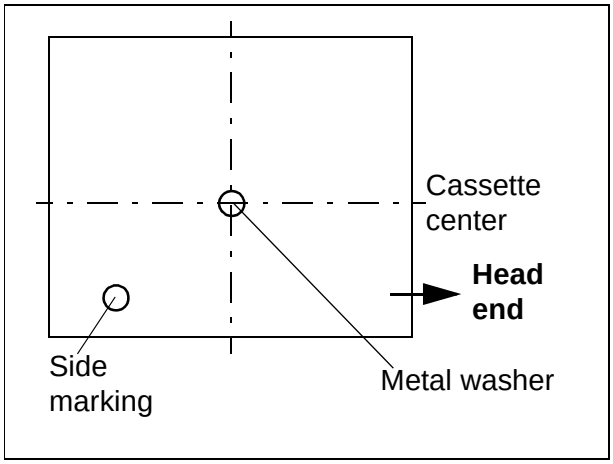


Fig. 1

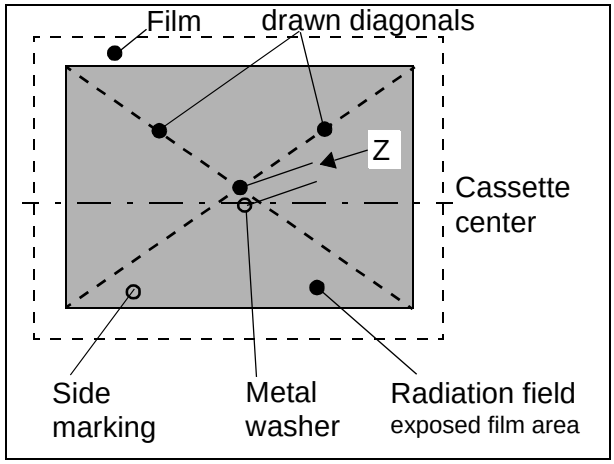


Fig. 2

NOTICE

The central beam has been adjusted at the factory and documented on page 4 of the test certificate.
Take a few test exposures to ensure that the setting has not changed during transport and installation.
The test certificate is contained in the UROSKOP D logbook, RLL5-310.066.

DHHS

RöV §16

- Mark the center of a 24 cm x 30 cm (10" x 12") cassette by attaching a metal washer (Fig. 1).
- Attach a second washer to the cassette as a side marker (Fig. 1).
- Insert the cassette which has been loaded with film in the longitudinal direction (side marking at the head end).
- Collimate the radiation field smaller than the cassette format (approx. 15 cm x 15 cm).

Set the exposure data: approx. 40 kV, 5 mAs and large focus ■ (with universal film screen).

- Make one exposure each with the table in the 0°,+88° and - 15° position in each case.
- Develop the three films.
- Draw the radiation field center onto the developed film (Fig. 2).
- Measure the deviation (z/Fig. 2) between the radiation field center and the center marking (washer) on the 2 exposures (Z1, Z2).
- Compare the measured deviations Z1, Z2 with the factory test exposures and enter the values into the *UROSKOP D* test certificate, "Coincidence of radiation field center and film center".
  The difference from the values determined at the factory may be max. 2 mm.
  Max. acceptable deviations: ≤ 1 cm
- If the deviation is greater than > 1 cm, adjust the central beam according to the adjustment instructions and repeat the test exposures.

The accuracy of collimation for the PBL system is tested for three formats.
Film subdivisions can also be selected.
The table position is unimportant for this test.

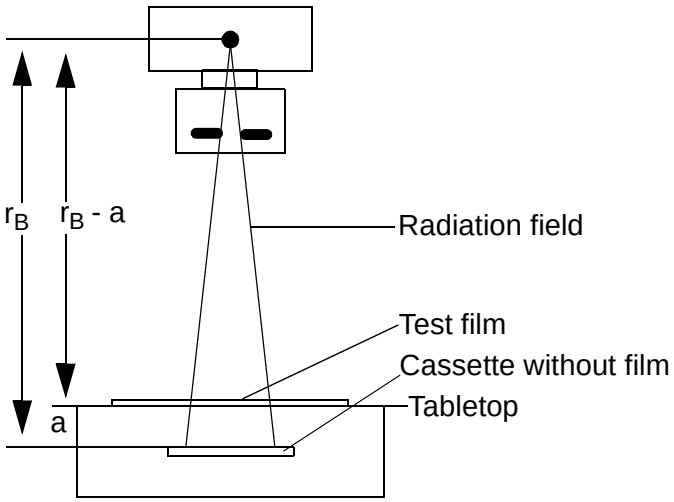
Test conditions

- Expose 3 formats onto one film.
- With large focal spot

DHHS

r_B = 115 cm
a = 7 cm
r_B = 108 cm
M = r_B / (r_B - a) = <u>1.065</u>

RöV §16



- Use a 35 cm x 35 cm cassette with film and place it on the tabletop diagonal to the table edges and centered to the central beam.
- Close the collimator all the way.
- At the generator select the large focus and approx. 50 kV, 25 mAs.
- Now insert three cassettes consecutively (film subdivisions as well, if necessary) without film in the spotfilm device, starting with the smallest format. Release one exposure for each format. Select full view form for all exposures.
- If available, use the three formats of 18 cm x 24 cm, 24 cm x 30 cm and 35 cm x 35 cm for the test.
- The three exposures are shot over one another on the same film. The evaluation is possible due to the different film density of the individual formats.

NOTICE **Ensure that the format is always collimated from the smaller to the larger collimator aperture.**

- Develop and label the film.

Evaluation

- Measure the length and width (l' and b') of the three radiation fields on the film and record the values.
- Use the factor M for converting the radiation fields from measurement plane to film plane.

  $M = r_B / r_B\text{-}a = 115 / (115 - 7) = 1.065$

- Using M, calculate the radiation field sizes in the film plane (l and b) from the measured field sizes (l' and b') and record the values.

  $l = l' \times M;\ b = b' \times M$

- Calculate and record the deviations between nominal format (l_N and b_N) and actual radiation field size in the film plane (l and b) referenced to the SID (r_B).

  Tolerance:

$$\left| \frac{l - l_N}{r_B} \right| \leq 0.02; \quad \left| \frac{b - b_N}{r_B} \right| \leq 0.02 \text{ corresponds to } 2\%$$

Check whether the coincidence between the radiation field and fluoro field are displayed on the monitor for all image intensifier formats. In addition, check the centering of the radiation field to the monitor image center in the extreme table positions.

Test conditions

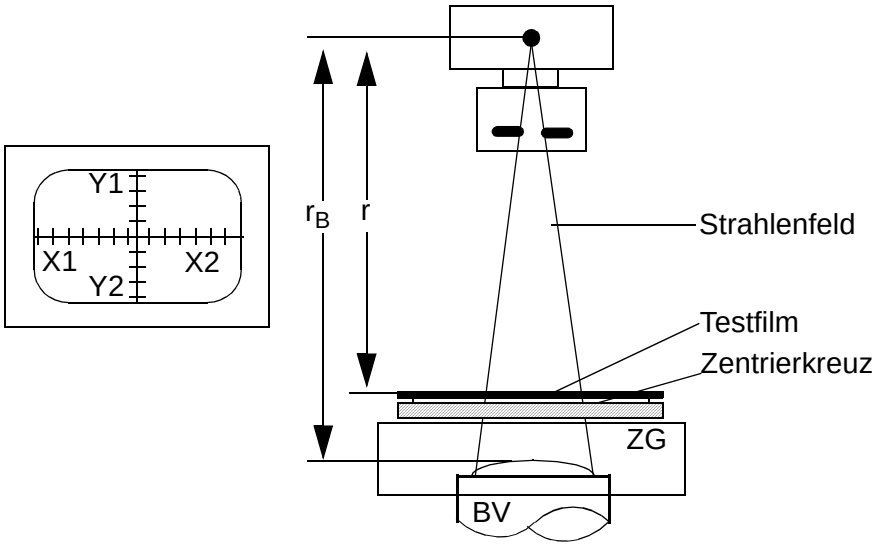
FLUORO field limitation:

- In one table position
- For all I.I. formats

Centering:

- In 3 table positions
- For I.I. full view format

RöV §16



Brief description of the test

- Center the centering cross to the central beam under fluoroscopy.
- Open the collimator to maximum aperture and verify that the collimator blades are visible on the monitor.
  If yes, the check for overframing is not required.

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- Count and record the cm scale divisions of the 4 coordinates X_1, X_2, Y_1, Y_2.
- If the collimator blades are not visible, place a film envelope with test film in the plane at the centering and release fluoroscopy (approx. 20 sec.).
- **Evaluation:**
  Compare the radiation field on the test film with the field size on the monitor.
  Determine overframing in % of the SID.
  Determine the off-center and calculate it in % of the SID.

Visual check of the fluoroscopic field limitation

- Align the central beam perpendicular to the I.I. and move the tabletop into the horizontal position or into a frequently used mid-range position. Record the tilt angle of this position.
- Do not insert a cassette in the spotfilm device. Select I.I. full view format.
- Open the collimator to maximum aperture and verify that the collimator blades are still visible on the monitor.
- Perform this check for all I.I. formats and record whether the collimator blades are visible on the monitor.
- Determine and record: source-centering cross distance (r), SID = 115 cm.
- This completes the fluoroscopic field limitation check for all formats in which the collimator blades are visible on the monitor.
- The degree of overframing must be determined for those formats in which all collimator blades are not visible.

Checking the overframing of the fluoroscopic field size displayed on the monitor

- Maintain the mid-range table position.
- Attach the centering cross to the tabletop so that the X axis is horizontal.
- Collimate a small radiation field and center the centering cross to the radiation field under fluoroscopy.
- Open the collimator to maximum aperture. Proceeding outward from the center of the centering cross, read and record the cm divisions of the 4 coordinates X_1, X_2, Y_1, Y_2 in width and height displayed on the monitor.
- Perform this for all I.I. formats in which the collimator blades can no longer be seen on the monitor at maximum collimator aperture.
- Place a film envelope with test film in the plane at the centering cross and release fluoroscopy at maximum collimator aperture until sufficient film density is obtained.
- Repeat this for all I.I. formats in which the collimator blades are **not** visible on the monitor.
- Make one test film each with the formats to be tested and label.

Checking the centering of radiation field and monitor image center

- Select I.I. full view format. Maintain the mid-range table position.
- Unless already done, center the centering cross to the central beam (tabletop) and open the collimator to maximum aperture.
- Proceeding outward from the center of the centering cross, read and record the cm divisions of the 4 coordinates X_1, X_2, Y_1 and Y_2 displayed on the monitor.

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- Repeat the same procedure in the two extreme positions of the table: collimate small, center the centering cross to the central beam, open the collimator to maximum aperture, read off and record the scale divisions in the X and Y axis.

Evaluation of overframing in fluoroscopy

- Measure the width and length of the radiation fields displayed on the test films and record the radiation field sizes (l and w).
  The difference (overframing) between the radiation field size (l and w) and the field size displayed on the monitor ($X_1 + X_2$ and $Y_1 + Y_2$) is determined and calculated in % of the source-centering cross distance:

  Tolerance:

$$\left| \frac{b - (X_1 + X_2)}{r} \right| \leq 0.02; \quad \left| \frac{l - (X_1 + X_2)}{r} \right| \leq 0.02 \text{ corresponds to 2\%}$$

Evaluation of off-center in fluoroscopy

- The off-center deviation (z_x and z_y) of radiation field and monitor image center is calculated in each case in the X and Y direction for all table positions (tilt angles) tested:

$$z_X = \left| \frac{X_1 - X_2}{2} \right| ; \; z_Y = \left| \frac{Y_1 - Y_2}{2} \right| ;$$

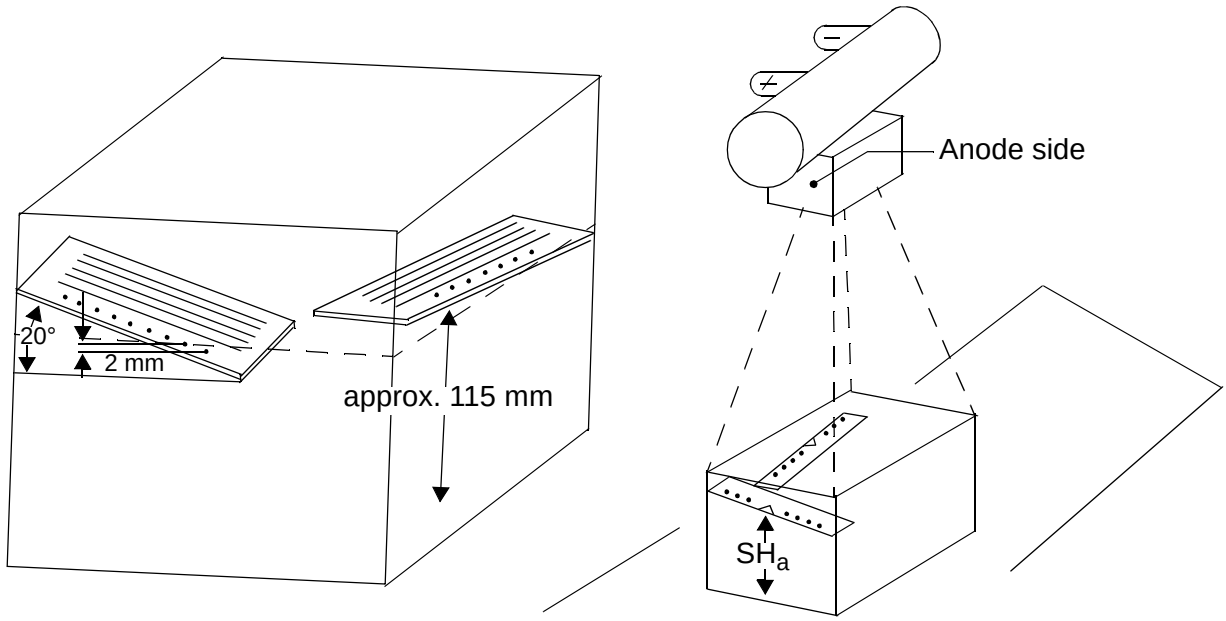
- The off-center deviation is calculated in % of the source-centering cross distance.

  Tolerance:

$$\frac{z_X}{r} ; \leq 0.02 \quad \frac{z_Y}{r} ; \leq 0.02 \text{ corresponds to 2\%}$$

NOTICE

The tomographic device has been adjusted at the factory. The setting is documented in the test certificate and via three test exposures included in the shipment. Take a test exposure to ensure that the setting has not been changed during transport and installation.



- Move the tabletop into the horizontal position and select "tomography" operating mode.
- Place a foam cube with definition tests on the tabletop and center it to the light localizer. One definition test must be located on the anode side, the other test must face towards the tube assembly support arm.
- Ensure that the notches of the two definition tests are located at the same height above the tabletop; measure this dimension (approx. 11.5 cm) exactly.
- Select the tomographic height so that the numerical tomographic height display corresponds exactly to the measured "notch height".Record this dimension as selected tomographic height "**SH_a**" in the test certificate under section 12.
- Load film into an 18 cm x 24 cm cassette with high-resolution film-screen combination and insert it into the spotfilm device.
- Collimate the field size onto the surface of the test phantom.
- Select the small focus (■) and insert a 0.3 mm Cu filter into the collimator.
- Select the tomographic pattern indicated in the test certificate for the 1st exposure and set the specified kV value and mAs value.

☢ • Release a tomographic exposure and develop the film.
The basic film density should be approx. D = 1 to 1.4.

☢ • If necessary, repeat the exposure with a different mAs value.

Accuracy of the tomographic height display

- The sharply delineated hole of the definition test is located in the tomographic plane.

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- If the hole near the notch is delineated sharply, the numerically displayed tomographic height $\mathbf{SH_a}$ coincides with the actual tomographic height **SH**, i.e. $\Delta\ \mathbf{SH_a = 0}$.

- In the case of deviations, determine the height difference $\Delta\ \mathbf{SH_a}$ in mm between the sharply delineated hole and the notch (the height difference from one hole to the other is 0.2 cm).
  When the actual tomographic height is located above the notch, then $\Delta\ \mathbf{SH_a}$ is positive.
  When the actual tomographic height is located below the notch, then $\Delta\ \mathbf{SH_a}$ is negative.
- Determine and record the actual tomographic height $\mathbf{SH = SH_a + \Delta\ SH_a}$.

  The deviation $\Delta\ \mathbf{SH_a}$ must be $\leq$ **0.5 cm**.

Resolution and tomographic procedure

Compare the test exposure made during system start-up at the customer site with the corresponding test exposure made at the factory:

- Using a magnifying glass (min. 6x magnification), determine and record the maximum visible resolution of the test exposures.
  The resolution may not deviate from the resolution of the factory test exposure by more than one line group; the minimum resolution must be $\geq$ 2 Lp/mm.
- The shape and course of the tomographic pattern and the evenness of the blurring on the test exposure must be comparable to the factory test exposure.

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- **Assessing the test exposures:**
  Compared with the resolution of the Bucky exposure, the resolution of the tomographic exposure may not deviate by more than one line group.
  The blurring shadows of the holes and lines must run in parallel over the entire range.
  If this is not the case, then the film path and the focus path are not in parallel.
  Wavy lines may be caused by oscillations in the system.
- The different film densities of the imaged holes may be caused by grid interferences (this cannot be avoided - it is not critical.)

General

The following test measurements for the image quality test certificate ensure that the system is functioning correctly and that the factory settings have not changed.

Important: To record the measured values, use the IQ test certificate RXD0-000.037.01... The paragraphs indicated in brackets in the following text refer to this test certificate.
The test certificate is located in the UROSKOP D logbook, Register 9.

The customer's address, system overview and the required measurement instruments (para. 1, 1.1, 1.2 and 1.3) must be recorded.

Preliminary remarks

Basic information on the dose / dose rate measurement for I.I. workstations

For dose measurement at the I.I. input (K_B) or dose rate measurement at the I.I. input (K_B), attach the dosimeter chamber as close as possible to the I.I. In the case of spotfilm devices, place it in the cassette shaft.

NOTICE	**Press the emergency STOP button on the Uroskop.**

If this is not possible, measure the dose (K_{Tg}) or the dose rate (K_{Tg}) in front of the attenuating layers, on the tabletop.

The measured value is converted into the value at the I.I. input using correction factor m (unit attenuation factor).
The unit attenuation factor contains all attenuating layers between patient, image and receptor including the distance factor; it is specified in the test certificates and can also be determined by multiplying the attenuation factors of the individual layers.
A radiation attenuation of 6% by the dose measurement chamber must also be taken into account (factor 0.94).

Determining the dose/dose rate directly at the I.I. input

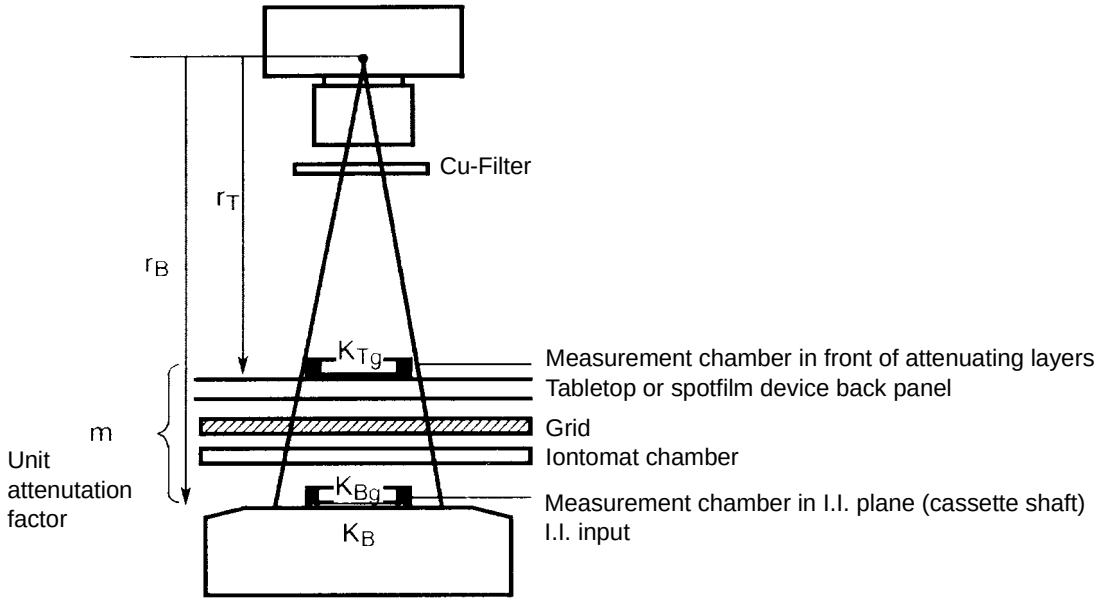
Place the dose measurement chamber in the beam path (UROSKOP D2, D3) for measurement. After the ADC has stabilized, press the STOP button. Factor 0.94 does not apply in this case.

Determining the unit attenuation factor from the individual attenuation factors

Attenuation factor of tabletop, back panel spotfilm device etc.	m_T
Attenuation factor of scattered radiation grid	m_R
Attenuation factor of Iontomat chamber	m_I

Distance factor attenuation factor $m_A = \left(\frac{r_B}{r_T}\right)^2$

Unit attenuation factor $m = m_T \times m_R \times m_I \times m_A \ldots\ldots$



K_B/K_B = dose/dose rate directly at I.I. input
K_{Bg}/K_{Bg} = measured dose/dose rate in I.I.plane
K_{Tg}/K_{Tg} = measured dose/dose rate in front of attenuating layers
r_B = source-image receptor distance
r_T = distance between source and start of the attenuating layers

Formulas for calculating the dose/dose rate in the measurement plane for dose/dose rate setting

During setting, the dose or dose rate required directly at the I.I. input must be converted into the measuring plane (I.I. plane or in front of attenuating layers). Use the modified formulas to do this.

	Dose	**Dose rate**
Ionization chamber in I.I. plane	$K_{Bg} = K_B$	$K_{Bg} = K_B$
Ionization chamber in front of attenuation layers	$K_{Tg} = K_{Bg} \times m$	$K_{TG} = K_B \times m$

Remark: With Polydoros S and SX generators, radiation attenuation via the dose measurement chamber is already taken into account during setting (for adjustment: move the dose measurement chamber out of the beam path). Do not use factor 0.94 for calculating the dose rate **to be set**.

Indirect dose rate test at the customer site

(Para. 4.1.2 Chapter 4)

Before setting different customer-specific fluoroscopic parameters, check via the indirect dose rate test that the factory settings have not been changed and that the system functions properly.

- Select the operating conditions documented in the IQ test certificate.
- Place 2.1 mm Cu (precision radiation filter 99 00 598) in the beam path.
- Open the collimator to maximum aperture.
- If the factory values (kV, mA) are obtained, transfer the dose rate values from table 4.1.1 to table 4.1.2.

***Notes on the acceptance test in Germany according to §16 RöV**:*

§16

After programming the customer-specific fluoroscopic parameters, the dose rate for all FL control stages and all I.I. formats must be measured and entered in the acceptance certificate together with the kV and mA values. Use 25 mm Al + 1.5 mm Cu as prefiltration. The dose rate values measured with 25 mm Al + 1.5 mm Cu correspond to the values measured with 2.1 mm Cu; the resulting kV and mA values are different.

Setting when the indirect dose rate is out of tolerance

(Para. 4.2.1 Chapter 4)

If the dose rate must be readjusted after repair work etc., the dose rate measured must be entered in the image quality test certificate under “Resetting the dose rate”.

Perform measurement of the dose rate and determination of the kV and mA values as well as the documentation as described above.

NOTICE	**Switch the dose meter on at least 15 minutes before measurement and calibrate it.**

Test conditions:

For dose rate measurements, program the antiisowatt curve (C00) to Fluoro 2 and then perform the checks.

- Source-I.I. distance: 118 cm
- Attach 2.1 mm Cu to the collimator.

Sequence of work:

- Connect DVM to POLYDOROS D901 X2.1 and 7.
- Move the table into its center position so that table rails lie outside the beam path.
- Select full view I.I. format and open the collimator to maximum aperture.
- In the”Adjustment” service program, set ”Skindoserate” to the maximum value, at 110 kV and 70 kV.
- Press the EMERGENCY STOP button.
- Place the measurement chamber in front of the I.I., measuring range 1.0 µGy/s, and center it.
- Select ”Adjustment”/”Doserate”.

- Click on ”Start Measuring”.
- Increase the current until 876 µGy/s are reached and confirm with ”ok”.
- Remove the measurement chamber.
- During fluoroscopy, the DVM must read 700 mV ± 35 mV; adjust with D100/R1 (in light distributor) (check with closed light distributor).
- Perform the adjustment.
- Exit the service program with ”Syst. disconnect”.

Maximum skin dose rate

(Para. 4.4.2 Chapter 4)

Measure and record only if required by the country-specific regulations (USA, Canada).

- Full I.I. format
- Min. SID
- Cover I.I. to protect it from radiation (protects input layer of I.I.) and remove the fuses of the I.I. power supply (TV-camera).
- Position the dose measurement chamber 30 cm above the tabletop.
- Ensure that the dose measurement chamber is exposed completely.
- Measure the resulting dose rate at all ADC control stages.
- In each case, record the kV and mA values produced (display of the generator console).

During start-up, perform measurements for all control stages described above that have not yet been checked at the factory (customer-specific ADC control system parameters). Enter the ADC control system parameters already checked at the factory from table 4.4.1 in 4.4.2.

DHHS ***Notes on the acceptance test in USA and Canada according to DHHS regulations:***
Use the maximum skin dose rate values obtained at the factory and during start-up for the acceptance test certificate.

Function check of ambient light sensor

- Switch on the ambient light sensor.
- Cover the ambient light sensor with your hand:
  The monitor image must visually change.
- Switch off the ambient light sensor again.
- Perform all other IQ checks with the ambient light sensor switched off.

B-signal values (without bias light/dark current component)

(Para. 5.3.1 Chapter 5D)

Notice:
Measure the B-signal with expanded time base (greater accuracy of measurement) in the line center and noise center of a line in the image center (Fig.1).

Test conditions:

- Insert the grid
- Source-I.I. distance: 118 cm
- Attach prefiltration of 2.1 mm Cu to the collimator

Sequence of work:

- Switch on fluoroscopy, select or program antiisowatt curve C00
- Measure and record the B-signal for all I.I. formats
  Table 5.3.2 (without bias light/dark current component)
- Switch off fluoroscopy

.

Notes:

During repeat measurements, th
e B-signal values may drop by up to 15 mV compared to the values measured when setting the iris diaphragm depending on the system. In this case, repeat the setting and taking the measured deviation into consideration, remeasure and record the results.

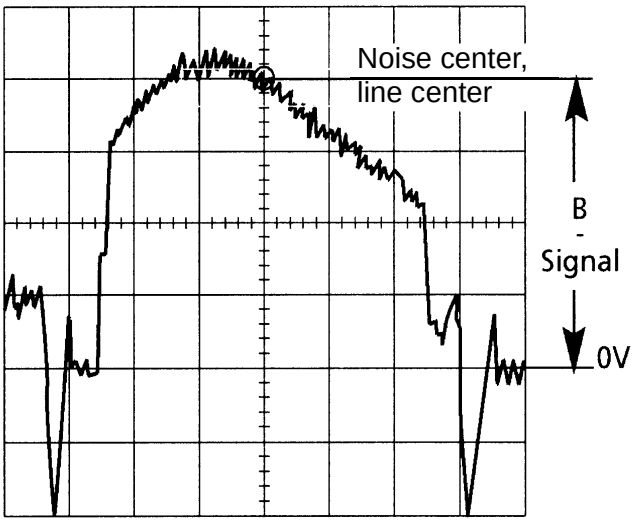


Image artifacts (Para. 5.10 Chapter 5D)

- Mark all image artifacts which are detected during setting and image quality tests in the table in the image quality test certificate. The test points listed in the table indicate measurements in which each artifact generated is stronger and/or can be better evaluated.
- If any image artifacts are detected which are not listed in the table, these must be described under ”Other artifacts”.
- To assess the respective artifacts, there are three rating numbers which indicate the extent of each artifact:

Definition of the rating numbers:

1 =No artifacts could be determined during start-up.

2 =A few artifacts occurred sporadically during start-up. The cause could not be located and the”error” could not be corrected. The artifacts do not adversely affect the overall appearance of the images and do not compromise the diagnostic value of the images in any way. The artifacts are determined to be tolerable.

3 =During start-up, artifacts of greater severity occurred frequently and they negatively influenced the overall appearance of the images or compromised their diagnostic value. Therefore, the artifacts were determined to be intolerable and the system could not be turned over to the customer.

Description of the artifacts

- **Hum:**
  Inhomogeneity caused by electromagnetic fields in imaging systems. This artifact may significantly influence the diagnostic value of the images depending on the type of interference. Ideally, this artifact should not occur at all. However, extremely low levels can be tolerated. Hum artifacts appear as periodic, horizontal bright and dark structures in the image; they appear randomly and are not specific to one location.
- **Streaks:**
  Very high-frequency electromagnetic fields appear in the image as bright or dark, sometimes very short, transverse streaks in the image. They are transient. Streaks caused by contaminants on the surfaces of lenses, etc. should be included in this group. In this case, they are specific to one location and are constant. Streaks are unacceptable.
- **Fraying:**
  Fraying is caused by strong black-white transitions due to ”overmodulated” video amplifiers. The object edge is ”distorted” laterally to the right. Slight fraying on the black-white step can be tolerated.
- **Ghosting:**
  These artifacts are object contours displayed twice, with the second contour generally shifted laterally. They are caused by reflections in long, poorly adjusted video cables. Clearly visible ghosting is unacceptable.
- **Microphonics:**
  Microphonics is caused by mechanical oscillations (rotating anode running, etc.) which are transferred to the TV camera, influence the deflection fields of the electron beam and mostly display very regular interference structures similar to those generated by electromagnetic hum interferences in the TV image. Microphonics is not acceptable.

General information and remarks

NOTICE

Unless otherwise indicated, the FLUOROSPOT is always enabled (no bypass) for the following tests.
Use organ programs as indicated; or generate them, if necessary.
List deviations next to the corresponding test point.

Organ programs for test purposes

Fluoro program:
For image quality acceptance test

Name:	Fluoro program
edge enhancement (%):	0
filter coefficient:	0
window upper limit:	511
window lower limit:	256
bone display:	black
Image:	no
motion detection:	not enabled
noise filtration (%):	

DR single image:
For image quality acceptance test
Enter dose value according to test conditions.

Name:	DR single
kV:	manual
kV manual:	70
dose:	100
exposure data from fluoro:	no
edge enhancement (%):	0
filter coefficient:	0
window upper limit:	511
window lower limit:	256
bone display:	black
Image:	no
organ curve:	manual-kV selected
kV for dose reduction:	manual-kV selected
maximum x-ray pulse width (ms):	3000
blackening correction:	0.0
focus:	small

DR series:
For image quality acceptance test

name:	DR series		
kV:	manual		
kV manual:	70		
dose:	100		
exposure data from fluoro:	yes		
frames per second:	0.5	(1)	(8)
maximum x-ray pulse width (ms):	1000	(800)	(65)
scene length (sec:	10s		
edge enhancement (%):	0		
filter coefficient:	0		
window upper limit:	511		
window lower limit:	256		
Bone display:	black		
Image:	no		
organ curve:	manual kV selected		
kV for dose reduction:	109		
stop mode of generator:	no		
blackening correction:	0.0		
focus:	small		
delta kV:	fixed focus selected		

DSA:
For image quality acceptance test
Enter dose value and frame rate according to test conditions.

Name:	DSA		
kV:	manual		
kV manual:	70		
dose:	100	(200),	(500)
exposure data from fluoro:	yes		
frames per second:	1/0,5/8	(1/6),	(1/6/8)
scene length:	10s	(10),	(5)
native display			
edge enhancement (%):	0		
filter coefficient:	0		
window upper limit:	511		
window lower limit:	256		
bone display:	black		
subtracted display			
edge enhancement (%):	0		
filter coefficient:	0		
window center (W1):	80		
contrast (W2):	220		
Image:	no		
organ curve:	manual kV selected		
kV for dose reduction:	109		
blackening correction:	0.0		
focus:	large		
delta kV:	fixed focus selected		

Image quality test exposures

The following images are stored on hard disk (HD) for systems pretested at the factory as a reference for the field service technician for system start-up.
Compare the test images taken during start-up at the customer site with the test images taken at the factory. This will allow you to detect and eliminate any deviations (e.g. deviations which have occurred since the factory test).

Name (Pat) name	Type of examination Identification	(Remarks on storage)
DR_Ramp	MP 8.2 (SS off)	Single / DR expos. => store 1 image
DSA_Ramp	MP 8.2 (SS off)	DSA series => save 1-2 images (precontrast), delete remaining images of the series
LIH_Dyn	MP 8.5 (Temp=0)	LIH => store monitor
DR_Dyn	MP 8.5 (– / 100)	Single/DR expos. => store 1 image
LIH_Resol	MP 8.7 (Temp=0)	LIH => store monitor for each I.I. format
DR_Resol	MP 8.7 (– / 100)	Single/DR expos. with each I.I. format
DSA_Resol	MP 8.7 (1/100)	DSA series with each I.I. format Save 1-2 images per series (precontrast) and delete remaining images
DSA_Dyn I	MP 8.9 (1/500)	DSA series => store 2 images, (mask, filling); delete remaining images of the series
DSA_Dyn II	MP 8.9 (6/200)	DSA series => save 2 images (mask, filling); delete remaining images of the series
DR_HOM	MP 8.10 (– / 100)	Single/DR expos. with solder tin cross
DSA_HOM I	MP 8.10 (1/500)	DSA series with solder tin cross => save 2 images (mask, filling); delete remaining images of the series
DSA_HOM II	MP 8.10 (6/200)	DSA series with solder tin cross => save 2 images (mask, filling); delete remaining images of the series

Dose/pulse test during start-up (indirect dose check)

(Para. 8.1.2 Chapter 8A)

CAUTION **No additional filtration must be selected on the multileaf collimator. The dosimeter must be switched on for at least 15 minutes and calibrated.**

The "indirect dose check" is a simple procedure used during system start-up to check whether the dose values set and recorded at the factory have changed.

For the ”indirect dose check”, place a 2.1 mm Cu filter (precision radiation filter 99 00 5988) in the beam path and measure the mAs value per pulse (Qg/n) with the collimator at maximum aperture. Subsquently, compare the values with the mAs value per pulse measured at the factory.

For each measurement, set the same operating parameters as used at the factory (IQ test certificate, page 6-1); (refer also to dose/pulse, page 9-5 to 9-7).

The test conditions and preparations are the same as described under 8.3.1, but without the dosimeter. The notes and test procedure provided under 8.1.1 apply.

If the results of the indirect dose test match the factory values for mAs/pulse (recorded on page 6-1 of the IQ test certificate), transfer the dose values from the tables on page 6-1 to the tables on page 6-2. If the mAs values deviate by more than ± 15% from the factory values with identical tube voltage, measure the dose/pulse again as described on page 9-5.

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Notes on the acceptance test in Germany according to § 16 RöV:
Enter the measured dose values/pulse in the acceptance test certificate.
The dose values measured with 2.1 mm Cu correspond to the values produced with 25 mm Al + 1.5 mm Cu. The mAs values/pulse that depend on the prefiltration are not enteed into the acceptance test certificate.

BA (video+blanking) signal values / setting the iris diaphragm in DR operation

(Para. 8.4.2 Chapter 8A)

Test conditions and preparations:

- Source-I.I. distance: 118 cm
- Attach 2.1 mm Cu prefiltration to the collimator
- I.I. format: 22 cm, 23 cm, 27 cm or 28 cm
- Connect oscilloscope: CH1 to FLUOROSPOT output (video output/Live= Trans.panel TP5.

Sequence of work:

BA-signal with LIH with Fluoro 1:

- Select fluoro program on the FLUOROSPOT as described on page 9-1: W1 = 511, W2 = 256, etc.
- Switch on dig. FL with Fluoro 1 (C00) and record the stabilized kV value (Ua); FL OFF.
- Measure and record the BA-signal for LIH:
  Select a line in the image center (line 256 / 60 Hz, line 312 / 50 Hz); measure the level in the line center and noise center.

BA-signal with DR exposures:

- Select DR organ program on the FLUOROSPOT as described on page 9-1: 70 kV, W1 = 511; W2 = 256, etc.
- To ensure that dose control and iris control are interacting properly, make the following consecutive exposures and measure and record the BA-signal respectively at the FLUOROSPOT output:

DR single image	-	dose 50; dose 100, dose 200
DR series with 0.5 f/s	-	dose 50, dose 100; dose 200
DR series with 8 f/s	-	dose 50, dose 100, dose 200

- In each case trigger fluoroscopy briefly before releasing the exposure.

Remarks: There is only one iris correction value for all indicated DR modes. For single images and dose 100, set the BA-signal as precisely as possible to the nominal value to maintain the tolerances for all modes.

- Record the iris correction value for the DR exposures.

Start-up of systems at the customer site:
When starting-up prestaged systems, check only the BA-signals for dose step 100. The values must be within the tolerances specified in the list of nominal values. If the tolerances are not maintained, the iris correction value must be changed and the whole measurement series must be repeated.

Dynamic test

CAUTION **During measurements with the dynamic test, no additional filter must be selected on the multileaf collimator. The nominal values refer to a tube voltage of 70 kV.**

Amplitudes/ Setting the iris diaphragm for DSA mode

- The BA-signal amplitudes of the different attenuation levels of the dynamic test are measured at the FLUOROSPOT output with a tube voltage of 70 kV. The required video+blanking levels are obtained by correctly adjusting the iris diaphragm.

Remarks: The iris diaphragm has already been adjusted for FL mode (test point 5.3) and for DR exposures (test point 8.4) with a homogeneous (2.1-mm Cu) phantom and may not be changed. Adjust the iris diaphragm with the dynamic test for DSA mode.

Test conditions and preparations:

- Source-I.I. distance:

  OT units = 115 cm

- Grid inserted
- I.I. format: 22 cm, 23 cm, 27 cm or 28 cm
- Attach dynamic test close to the I.I. (with heart contour diaphragm and new capillary displacement test, part no. 97 50 019).

  OT units - on the tabletop

Remarks: For UROSKOP D3, position the dynamic test approx. 25 cm above the tabletop so that the ring-shaped dominant is located in field 1.

The dynamic test must be displayed on the monitor as shown in Fig.1; if necessary, change the position of the guide rails on the test.

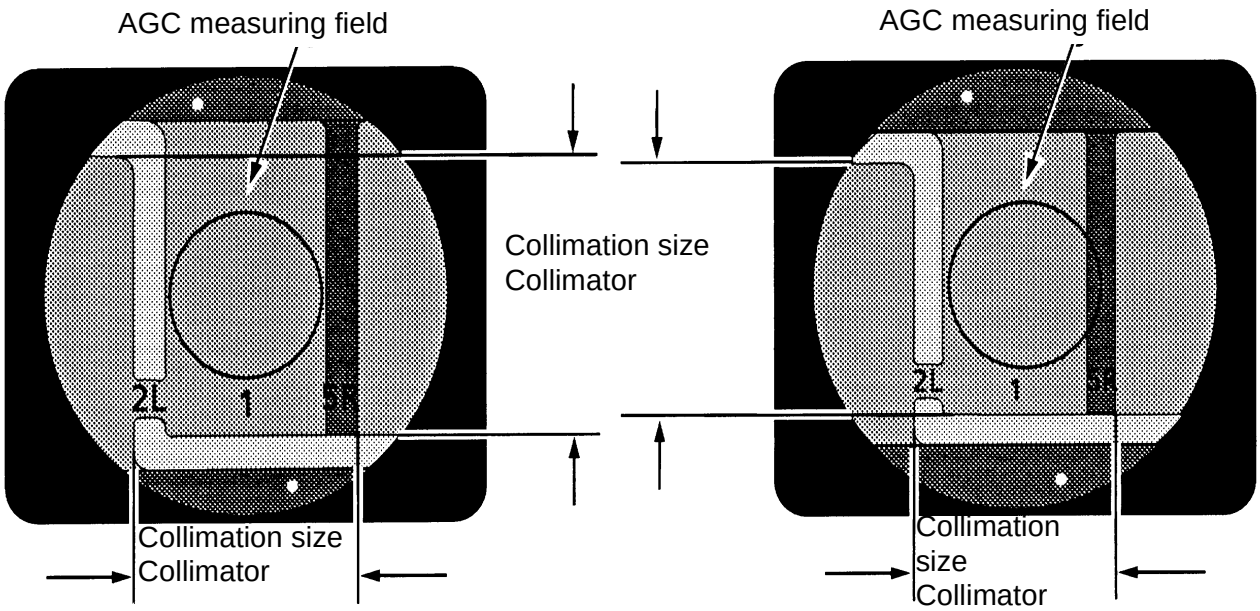
- Connect oscilloscope: CH1 to FLUOROSPOT output (video output/Live) = Trans. panel TP5.

Procedure:

Amplitudes with LIH:

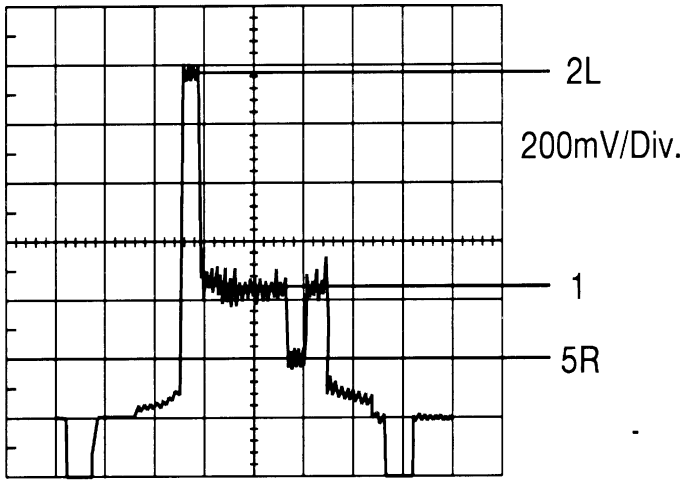
- Select fluoro program on the FLUOROSPOT as described on page 8-1: W1 = 511, W2 = 256, etc.
- Switch on dig. FL with Fluoro 1 (C00). Center and collimate the dynamic test (Fig.1). After collimating, release fluoroscopy for a short time (approx. 5 s) until the ADC has adjusted.

Remarks: The nominal values for the BA amplitudes with LIH can be obtained only if the AGC measurement field is covered completely by the 1st field of the dynamic test. This is assured by the AGC measuring field size (progressive) marked in 5.6.1.
If the AGC measurement field exceeds the 1st field, shift the dynamic test until the 2L field is safely outside the AGC measurement field and only the 5R field projects into the AGC measurement field.
The 5R field does not distort the measurement as much as the 2L field. This applies to the rectangular ADC measurement field as well.
Do not undercollimate the ADC measurement field so that the dose values for the exposure match.



- For LIH, measure and record the BA-signal amplitudes of fields 2L, 1 and 5R of the dynamic test: Measure a line in the approx. image center (approx. line 256) and noise center.

BA-signal output
FLUOROSPOT



Line in image center

Important: **Do not measure on a line which is covered by a capillary. To ensure this, move the expanded time base back and forth by a few lines; the amplitude should not change. A capillary reduces the BA-signal.**

- Record the resulting kV value (Ua). If the value deviates from 70 kV, the dynamic response of the BA-signal changes.
  - At < 70 kV, the difference of the BA-signal between fields 5R and 2L increases (higher dynamic response).
  - At > 70 kV, the difference of the BA-signal between fields 5R and 2L decreases (lower dynamic response).

Amplitudes with DR exposure:

Select a DR organ program on the FLUOROSPOT as described on page 8-1: 70 kV, W1 = 511, W2 = 256, etc., select dose 100, single image on the unit

CAUTION **The iris correction must be =0 on the generator console and in the organ program.**

- Switch on FL for approx. 5 s.
- Release DR exposure and measure and record the BA-signal amplitudes of fields 2L, 1 and 5R of the dynamic test:
  Measure a line in the approx. image center (approx. line 256) and noise center.
- Record the indicated kV value (Ua).
- Measure and record the iris voltage value U_{act} or U_{IRIS} on M98/D2 resp. N84/D2 or PL-SX:N11/D270. This test point does not apply to prestaged systems.

Amplitudes with DSA exposure:

The iris setting is checked in DSA mode (constant time mode) for both exposure times (0.5 - 4 f/s = 233 ms; 6 - 8 f/s = 100 ms) because a different iris correction value must be set for each of the two constant times.
The DSA test scenes will be required at a later point.

Select a DSA organ program on the FLUOROSPOT as described on page 8-2 (subtraction): 70 kV; W1 = 511; W2 = 256 (precontrast exposure), etc.

CAUTION **The iris correction must be =0 on the generator console and in the organ program.**

- Before releasing the DSA scenes, prepare the shift test.
- Release one DSA scene with the following exposure data and actuate the displacement test after approx. half of the scene time has elapsed.
  - Dose 500; 1 f/s; scene time = 10 s.
  - Dose 200; 6 f/s; scene time = 5 s.

To ensure that defined, reproducible exposure parameters are accepted during test scenes, proceed as follows:

1. Select a scene with the desired organ program.
2. Release fluoroscopy for approx 5 s. to allow the ADC to adjust; then the water value computer sets the correct exposure data.
3. Release a short scene (5-6 images) to allow the dose to adjust in constant time mode.
4. Release the actual test scene without previous fluoroscopy and evaluate the scene. Delete the first short scene.

- Evaluate the next to last **native image** of each scene:
  Measure and record the BA-signal amplitudes of fields 2L, 1 and 5R of the dynamic test. Measure a line in the approx. image center (approx. line 256) and noise center.

Please note the important information on page 8A-16.

- Record the indicated kV value (Ua) and record the fixed programmed iris correction value.
- Measure and record the iris voltage value U_{act} or U_{IRIS} on M98/D2 or N84/D2 or PL-SX:N11/D270. This test point does not apply to prestaged systems.

Remark: Due to dose scattering from scene to scene, the BA-signal values vary. To ensure that the level in the 2L field does not exceed the upper limit value, release at least 5 scenes at 6 f/s and evaluate them. If doubtful, set the iris a little smaller to avoid overmodulation of the A/D converter. In this case, the result does not have to be within the tolerance for field 1.
For FLUOROSPOTs with DSA, the BA amplitudes have to be measured at the factory and in the field. If there is no DSA option, the dynamic test does not apply for start-up at the customer site.

Edge enhancement

- Use the DR exposure with the dynamic test image on the monitor.
- Change EGDE ENHANCEMENT from E = 0% to E = 100%, check the function visually on the monitor and check whether it functions correctly.
  When the edge enhancement is increased, gray steps are displayed with white and black edges:
  - A white frame is formed around black areas (5R field)
  - A black frame is formed around white areas (circles around field numbers)

Mean value assessment (GGM= sliding weighted averaging)

- Place the dynamic test in the beam path as described in the preparations for 8.5.1.
- On the FLUOROSPOT, select the fluoro program as described on page 8-1 (temporal filtration = 0%)
- Switch on digital FL with Fluoro 1.
- Observe the noise impression of the image.
- On the FLUOROSPOT, increase the noise filtration in the fluoro program to 12%.
- Release fluoroscopy again and evaluate whether the noise in the image has been reduced.
  - Capillaries are more visible, etc.
  - Blurring is visible during movement of the object.
- Record whether the function is okay.
- On the FLUOROSPOT, reset the noise filtration in the fluoro program to 0%.

Resolution and minimum contrast

(Para. 8.7.2 Chapter 8A)

The determination of the resolution and the check of the minimum contrast can be done with one measurement arrangement in one test series.

Test conditions:

- Source-I.I. distance: 118 cm
- No edge enhancement (E% = 0)
- 6% Noise filtration during FL
- Open window, that means all gray levels are used (W1 = 511; W2 = 256)
- Fluoro 1 with FL (~ 70 kV)
- Dose step 100 for DR and DSA (70 kV)

Test preparations:

- Attach the lead bar test pattern, type 41 ① to the center of the I.I. and rotate it 45° from the horizontal position ② on the tabletop.
- Attach a 17 µm Cu strip ③ near the lead bar test pattern.
- Attach prefiltration of 1.2 mm Cu to the collimator.
- Switch on fluoroscopy.
- Collimate the radiation field ④ slightly larger than the lead bar test pattern (see figure). Do not undercollimate the ADC measuring field to avoid any overframing.

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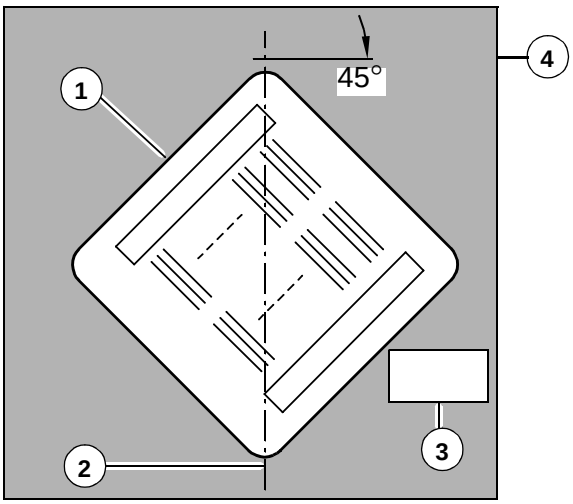
Notes on the acceptance test in Germany according to§ 16 RöV:

The resolution values measured with 1.2 mm Cu prefiltering and the minimum contrast (4% radiation contrast with 1.2 mm Cu and approx. 70 kV) evaluated with the 17 µm Cu strip correspond to the values measured according to the acceptance test conditions. Enter the values from the image quality test certificate into the acceptance test certificate.



Sequence of work:

- In each case, perform the check for the following modes with all I.I. formats.

Bypass	Dig. Fluoro	LIH	Super-vision	Dig. Exposure Dose 100	DSA* Matrix: 50Hz=1024 60Hz=884 F/s = 1	Hardcopy

* Evaluate the precontrast image.

- If more than one matrix size can be selected for DSA mode, the test should be performed for the largest and smallest matrix sizes.
- On the FLUOROSPOT, select the test programs described on pages 8-1 and 8-2 respectively and take into account the test conditions described above.
- Determine the max. visible resolution and record it in the image quality test certificate: darken the room, avoid any reflections.
- Check whether the 17 µm Cu strip (minimum contrast) is visible; enter **yes** or **no** in the image quality test certificate.
  The minimum contrast can be more easily detected at a greater distance to the object.

Checking the DSA system

(Para. 8.9.2 Chapter 8A)

Important image characteristics of the DSA system such as contrast sensitivity, logarithmic function and subtraction are checked by means of test exposures with the dynamic test. DSA scenes previously produced are evaluated for this purpose.
If the pedestal for Manual 1 had to be adjusted when checking the black level cutoff (noise halo), repeat the DSA scenes for the following evaluation.

Evaluation conditions:

- For evaluation, it is necessary to place the mask onto an image (if necessary, via REMASK) for which dose adjustment has been accurately performed:
  - with 6 f/s on image 8
  - with 1 f/s on image 3
- Window levels: brightness W1 = 80; contrast W2 = 220
- No edge enhancement; E (%) = 0
- In each case, evaluate the next to last DSA image of the series.

Contrast sensitivity:

- In the DSA image, check whether all capillaries are displayed on fields 2L, 1 and 5R of the dynamic test.
- Subsequently select DSA scenes 1 f/s and 6 f/s on the FLUOROSPOT and evaluate; postprocessing operating mode.
- In the test certificate, mark those fields in which the respective dark or bright capillary is no longer visible.

Logarithmizing function (LOG amplifier):

Logarithmic function is okay if the capillaries in the DSA image display the same gray level on all Cu steps.
The gray level of the top bright capillary (3 mm; 16) is measured on fields 2L, 1 and 5R by means of the DYNAMIC BOX.

- Connect the service PC to the FLUOROSPOT and call up ST 320.
- Select DSA mode on the FLUOROSPOT (not native display)
- On the FLUOROSPOT, call up PAT-DIR, TOOLS, SERVICE
- On the service PC, enter the following:

- Enter password
- **"IMAGE QUALITY ASSURANCE"**
- **"SELECT FOLDER FOR ANALYSIS",**

  Enter the folder name of the DSA scene.
- **"SELECT IMAGE FOR ANALYSIS",**

  Split image display is selected. Using the PC cursor keys (left, right), select the image.
- **"SELECT IMAGE FOR ANALYSIS",**

  The selected image is displayed.
- **"DYNAMIC BOX",**

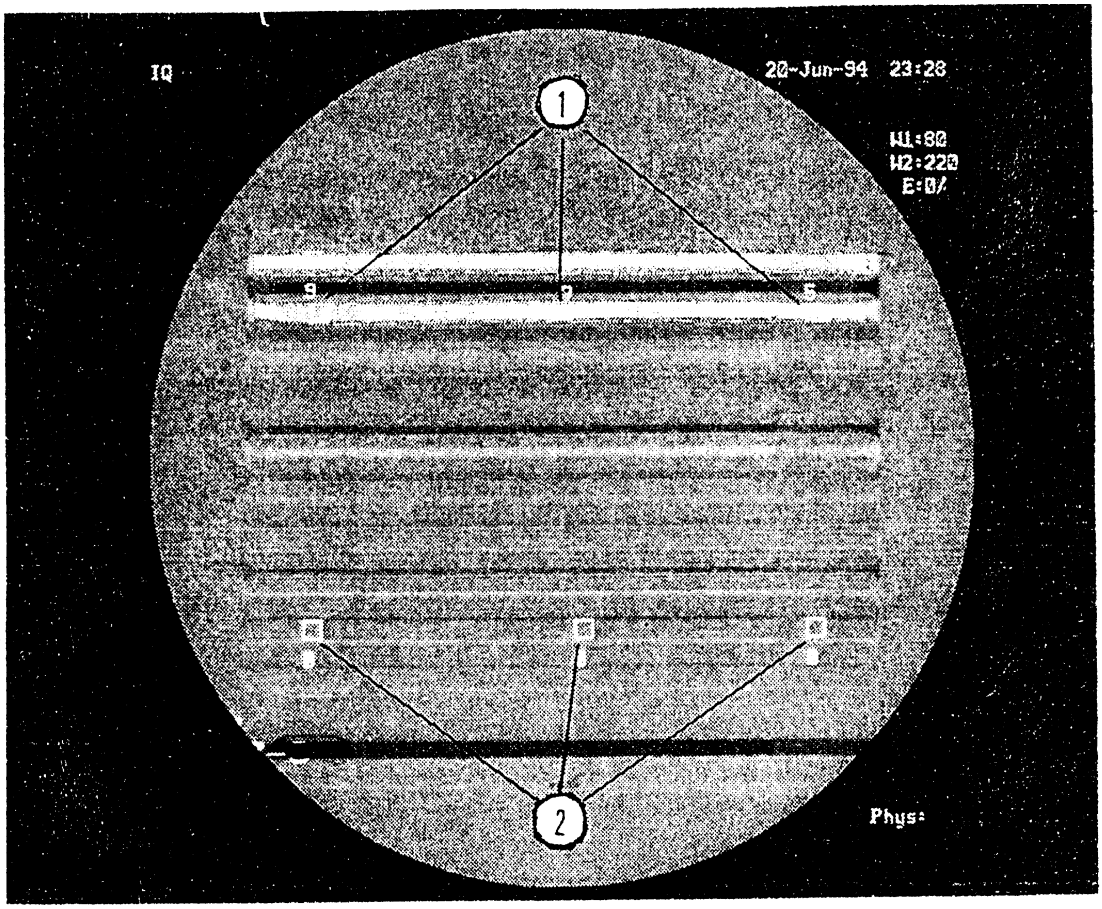
  The rectangular measurement field is displayed on the FLUOROSPOT monitor.

- **"MOVE BOX"**

  Using the PC cursor keys, center the square to the bright, 3 mm thick, 16% capillary.
  Ensure that the full width of the capillary is always located within the DYNAMIC BOX measurement field

  - In each case, measure the gray level of the capillary in fields 2L, 1 and 5R and record it (refer to 1/Fig.1)

.



The max. acceptable difference between the gray level of the 1st field and the gray level of the 2L field or the 5R field = 3 gray levels (refer to the reference value list).

Subtraction:

Subtraction is correct if all CU steps are displayed with the same gray level.

- Service PC: Using the cursor keys, move the rectangular measurement field between two capillaries (2/Fig.1).
- Measure and record the basic gray levels of fields 2L, 1 and 5R. The gray levels must be 0 ± 1.
  For the maximum acceptable deviation, refer to the reference value list.

Checking the hardcopy camera

Start-up and adjustment of the hardcopy camera (HCC) on our systems is the responsibility of the manufacturer or supplier. It is expedient for a Siemens service engineer to be present during the start-up/adjustment so that connection and image quality problems can be quickly resolved.

Checks and documentation for the HCC within the scope of IQ testing are limited to the following items:

- Documentation of brightness and contrast settings (Look-up tables) of the HCC at the time of customer turnover.
- Checking and documenting the contrast gradient and the geometry of the test films during evaluation of the SMPTE test image.
- Checking and documenting noise-free image transfer from the DFR system to the HCC and correct camera function.

Adjusting the hardcopy camera

The brightness and contrast control elements on the hardcopy camera vary according to the manufacturer. They range from switches with dials to software switches in the service PC.
The brightness and contrast settings (LUT) must be documented so that claims with respect to the HC image quality can be compared to test films generated during start-up and produced under the same conditions.

The information necessary regarding brightness and contrast settings differs and is specific to the camera. Respective texts have been provided in the IQ measurement certificate to assist with the documentation.

Preparing and evaluating the SMPTE test image

Call up the quality test patterns from memory on the FLUOROSPOT H and transmit them to the hardcopy camera:

> Special function→ Tools → constancy test → quality test (4:1 or 6:1) → send to HCC.

Evaluation:

Of the four quality test images, only the SMPTE test image is evaluated.

- Measure and record the optical density (blackening) of the 0% to 100% fields with the densitometer.
- Record as well whether the 5%- and 95% fields are visible.
- Evaluate and record whether the image geometry and the image sharpness are acceptable.

Geometry: The displayed fields must be square (equal side dimensions at right angles). All (lengthwise) lines and edges must be straight and not distorted.

Sharpness: All contrast resolution groups must be visible for laser cameras. This is not always possible for hardcopy cameras with built-in monitors.

Remarks: The film size and segmentation should be selected to that the sharpness (resolution) of the test exposures is not limited by the resolution capability of the hardcopy camera.

The test film should be archived as a part of the IQ documentation together with the IQ test certificate.

Image artifacts and transmission interference.

Remarks: As a rule, an error message appears on the DFR system or the hardcopy camera when there is transmission interference during digital image transmission from the DFR system to the hardcopy camera; i.e. you will be aware of image artifacts resulting from transmission problems.

The test film should be checked for image artifacts. The following artifacts are possible:

- Linear structures
- Fraying of sharp edges (Jitter)
- Inhomogeneity
- Artifacts
- Pixel errors
- Scratches, pressure marks, light leaks

If artifacts are visible, you must differentiate between those that are acceptable (e.g. for analog connected cameras) and those that are unacceptable. If the artifacts are not acceptable, the system may not be turned over to the customer.

The type of artifact should be documented in the space provided.

Information regarding the acceptance test in Germany according to§ 16 RöV:
The quality test image should be prepared twice and incorporated into the acceptance test log without further evaluation as documentation of the starting status of the hardcopy camera.

§16

Image artifacts

- Mark all image artifacts which have been detected during setting and image quality tests in the table in the image quality test certificate. The test points listed in the table indicate measurements in which each artifact generated is stronger and/or can be better evaluated.
- If any image artifacts are detected which are not listed in the table, these must be described under ”Other artifacts”.To evaluate the respective artifacts, there are three rating numbers which indicate the extent of each artifact:
  Compare the test images taken during start-up at the customer site with the test images taken at the factory.This will assist in detecting and eliminating possible deviations and new artifact occurrences.

Definition of the rating numbers:

1 = No artifacts could be determined during start-up.

2 = A few artifacts occurred sporadically during start-up. The cause could not be located and the ”error” could not be corrected. The artifacts do not adversely affect the overall appearance of the images and do not compromise the diagnostic value of the images in any way. The artifacts are determine to be tolerable.

3 = During start-up, artifacts of greater severity occurred frequently and they negatively influenced the overall appearance of the images or compromised their diagnostic value. Therefore, the artifacts were determined to be intolerable and the system could not be turned over to the customer.

Description of the artifacts:

- **Pixel errors** are image pixels without image information. They are visible as black dots in the precontrast image and are the size of pixels. In the DSA image, they can be displayed as black or white dots depending on whether the error is caused by the mask or the precontrast image.
  The causes are memory errors or address errors which are generated in the RAM or in the mass memory (postprocessing).
  Pixel errors that can be tolerated are sporadic, not stationary, only 1 pixel at one location, max. 3 pixels/image and with every 20th image only.
- **Ghost images:** These artifacts are contours displayed twice, with the second contour generally shifted laterally. They are caused by reflections in long, poorly adjusted video cables. Clearly visible ghosting is not acceptable.
- **Contouring** means horizontal or vertical ”streaks” which feign linear structures that are not present. They can be detected very easily in images which have been generated by a sawtooth signal by continuously changing the windowing. Slight contouring can be tolerated in the test described above.

- **Horizontal jitter:** Vertical object edges are not displayed on the monitor as ”sharply” delineated, but as slightly jagged, ”frayed” lines. Jittering results from slight irregularities in the horizontal deflection from image line to image line or during image storage and to a certain degree, it cannot be avoided. In the DSA image, jittering causes slight coincidence errors that can be tolerated.
  To perform the check, a solder tin cross must be attached to the I.I. center as precisely as possible in the vertical and horizontal direction, and a DR exposure must be made with dose step 100 and single frame with the smallest zoom format.
  Image evaluation criteria: Very narrow windowing with high contrast (e.g. W1 = 310, W2 = 309).

Island formation: Island formations are clearly delineated areas of the image which have a uniform gray level and are mostly displayed noise-free. Often they result from an insufficient storage depth and therefore contain wrong image information. So-called ”burnt-out” places in the image also come under this heading. They can be tolerated to a very limited degree only.

Vignetting is always present as a decrease in brightness from the image center towards the image edge. This is due to the brightness effect of X-radiation, the curvature of the I.I. input screen, the electron optics in the I.I., the tandem optics between I.I. and TV camera, the TV camera tube and the picture tube of the monitor. Vignetting is evaluated as an image artifact only if it shows up too extensively or is strongly asymmetrical (refer also to test item 5.4 in the image quality test certificate) or if there are large brightness differences which are irregularly distributed over the entire image.
If vignetting is within the limit values for fluoroscopy specified on pages 5-4 or 6-14, it can be classified as an ”image artifact” with evaluation number 1.

Artifacts conditional on exposure appear only in DSA images and are caused by exposure fluctuations from image to image during the DSA scene.
If two completely identical images (mask and precontrast image) are subtracted from one another, a uniformly bright image, without any structures, is obtained in which only noise is visible. If the exposure between the mask and the precontrast image is changed, an image structure is outlined in the DSA image, even if the object remains unchanged, as a result of the exposure difference. This is acceptable provided that it is only slightly outlined since, in medical exposures, a similar effect can be caused by patient movement.

Logarithmizing errors: The non-linear attenuation of the x-radiation depending on the object density and object thickness can be made linear to a large extent by applying a logarithm to the signal values of the image.
Incorrect setting of a logarithmizing stage causes a brightness step in the display of the vessel simulation of the DSA phantom. With the DSA standard phantom according to DIN 6868 part 8, the transition from the densest step (1.4 mm Cu) to the smallest step (0.2 mm Cu) is used for this evaluation. The gray level of the capillaries must be evaluated in fields 2L, 1 and 5R of the dynamic test with capillary test (refer also to image quality test certificate under 8.9). Slight brightness differences of the vessel simulation over the Cu steps of different thickness are acceptable.

- **Coincidence errors** appear only in DSA images.
  Artifacts called coincidence errors are generated in structured objects if the coordinates of corresponding projection elements do not coincide between image and mask. During the tests, only those coincidence errors are taken into account which are not caused by object movements.
  Image structures which occur due to a slight position change of the DSA phantom when shifting the vessel simulation cannot be avoided. However, they are identical in all DSA images of a series.
  The causes of undesirable coincidence errors are slight irregularities in the horizontal and vertical deflection of the TV system or errors when storing the image pixels.
  Slight coincidence errors can be tolerated since they do not preclude the ability to evaluate medical exposures.
  To perform checks, make DSA test scenes with dose step 200; 6 f/s and dose step 500; 1 f/s using the soldering tin cross (refer to the test for horizontal jitter) and in each case, evaluate the entire scene. Place the mask on an image for which dose control has been accurately completed.
- **Inhomogeneity (hum, line errors):**
  Each image displays certain inhomogeneities to a certain degree (refer also to vignetting), that do not influence the diagnostic accuracy of the exposures.
  Inhomogeneities caused by electromagnetic interference in the imaging system are unpleasant and disturbing and can, depending on the type of artifacts, considerably affect the diagnostic value of the images. It is preferable that they do not occur at all. They can be tolerated to a very small extent only. Hum interferences are displayed in the image as periodic horizontal bright/dark structures or as bright or dark transverse bars; they are volatile and not stationary.
  Any omission or partial omission of lines can be recognized as dark transverse streaks in the TV image.
- **Microphonics** is caused by mechanical oscillations (rotating anode revolution etc.) which are transferred to the TV camera, influence the deflection fields of the electron beam and mostly display very regular interference structures similar to those generated by electromagnetic hum interferences in the TV image. Microphonics is not acceptable.
- **Interference stripes:** Enter here all interference stripes which have not yet been described previously and whose generation is unknown.
  Even interference stripes which are caused by dirt on optical surfaces must be entered here. They are stationary and not volatile.
  Interference stripes are not acceptable.

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Notes on the acceptance test in Germany according to § 16 RöV:

The image artifacts detected during start-up are documented in the image quality test certificate and must be entered in the acceptance test certificate.

I.I. nominal values

Lead bar test pattern, type 42 directly at the I.I. input; no prefiltration; ≤ 50 kV; monocular at I.I. output.

I.I. Type	formats (cm)		R_{Gr} - at I.I. output (LP/mm)
	nominal	effective	
40 cm HDR - IS	40	36.5	2.8
	28	28	3.4
	20	20	4.0
	14	14	5.3

Remarks: The effective I.I. formats and the resolution at the I.I. output are not tested during the IQ test. The values are for troubleshooting only, if the resolution limit values for image reproduction fall below the limit.

Temperature indicator

Refer to RVB1-AA, 4.10/01 or RXD0-000.038.01... for nominal values.

ADC measuring field

MPL system

measuring field diameter, measured on 44 cm TV monitor

I.I. Type	selected Format	measur. field ∅ (cm)
40 HDR - IS	20	6.5 – 1

max. permissible center deviation (horizontal, vertical): 1.5 cm

***1** for older image intensifiers (before 3/93)

SDM system

I.I. Type	width of octagonal measuring field	acceptable center deviation	acceptable deviation of superimposed field
40 HDR - IS	7.6 ± 0.7 cm	0.7 cm	1.4 cm

Fluoroscopic dose rate at the I.I. input

2.1 mm Cu filter, X-ray tube voltage 65 - 85 kV

BV-Type / I.I. Type	Formate Formats	Dosisleistg. Dose rate NGy/s	Dose rate (nGy/s) Supervision	Zoom-Dose-Factors	
				PL S/SX ***2**	PL SC65/80
40 cm HDR - IS	40 28 20 14	87 160 315 (435)	44 80 158 (218)	1: 2.0: 4.0: 5.0	0.50: 0.92: 1.81: 2.50

$U_{Multiplier}$ = 700 - 950 V ***1**

1 nGy/s = 0.115 µR/s / 1 µR/s = 8.7 nGy/s

Tolerance: I.I. full format ± 10%; for zoom formats approximate values only.

Tolerance of the indirect dose rate control ± 1kV ±10%

Values in brackets ( ) apply if TV iris diaphragm is attached.

***1** effective beginning 7/93 (with masked Multiplier only)

***2** Zoom-Dose-Factors for PL S/SX approximate values only.

VIDEOMED SX, H1X Emulation

Values apply for 50Hz and 60Hz versions

TV monitor

Black level regulation = on

Luminance			mit / with DFR - System	ohne / without DFR-System
Test signal		0 % 100 %	BY = 0 - 5 mV BY = 700 ± 50 mV	BA = 0 - 10 mV BA = 1100 ± 50 mV
Shade 0 % (black			1 + 0.5 cd/m^2	1 + 0.5 cd/m^2
Shade 100 % (white):	new monitors		> 400 ± 20 cd/m^2	> 560 ± 20 cd/m^2
	used monitors		> 280 cd/m^2	> 300 cd/m^2

TV camera

Configuration values Video Gain			max. beam current(nA)
Interlaced	3	dB	1750
Progressive scan	3	dB	1750
Slow Progressive scan	6	dB	1400

target voltage			U = 49 - 52 V
grid voltage	U_{G1}		U ≤ – 15 V
B-signal: Bias light component (measured value)		Interlaced	U_{ss} = 28 ± 10 mV
		progressive	U_{ss} = 28 ± 10 mV
Sensitivity reserve: ⊚ 1, B signal (without bias light)			U_{ss} ≥ 95 V ***1**

***1** Limit value for new systems; measure and document at new systems only.

B signal value (interlaced - Bypass)

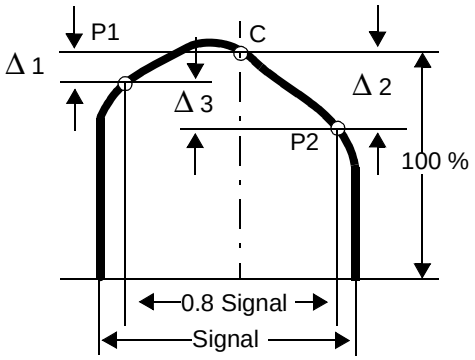
2.1 mm Cu / 2.1 mm Cu; without bias light

factory = 80mV; +15mV / – 10mV; for HK +15 / – 10 mV

start-up = 80mV; +10mV / – 20mV; for HK/ZOOM 1-3: +20/ – 20 mV

HK = high contrast curve

Vignetting (with bias light) (interlaced - Bypass)



$$\Delta 1 = \left| \frac{P1 - C}{C} \right| \times 100 \leq 30\ \%$$

$$\Delta 2 = \left| \frac{P2 - C}{C} \right| \times 100 \leq 30\ \%$$

$$\Delta 3 = \left| \frac{P1 - P2}{C} \right| \times 100 \leq 30\ \%$$

AGC measuring field sizes in grid units (GU)

I.I. format:	22 / 23 / 27 / 28 cm
round measuring field	6.5 ± 0.5 GE / GU
Center deviation	≤ 0.5 GE / GU
shift of analog measuring field	≤ 0.3 GE / GU

Pedestal and AGC function
Pedestal

AVR / AGC	interlaced	No test required	
AVR / AGC	progressive	No test required	
Fixed gain 1 / Hand 1		BA-Signal = 80±10mV	Presetting
Fixed gain 2 / Hand 2		BY-Signal = 50±10mV	

AGC-function: BA signals with 2.1 mm Cu (for all I.I. formats)

For sliding weighted control
interlaced = 350 ± 30 mV; progressive = 350 ± 30 mV
Difference between the I.I. formats 40mV

Fixed gain TV unit

TV central C.C.U			Fixed gain 1	Fixed gain 2
Input	B signal U_{ss} [mV]	D8: 15 99 898 D8: 37 94 208	2000 1410	2000 1410
Output	BA signal U [mV]		**1100** ± 20	**1050** ± 20

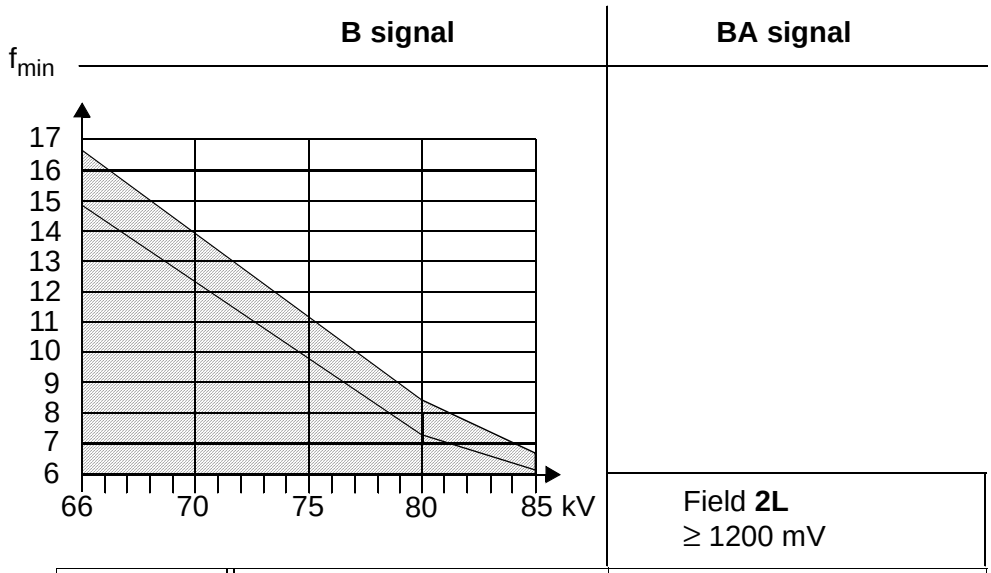
Dynamic test

I.I. format: 22cm – 28 cm

B/BA signal amplitudes

SID = Grid focusing distance

Dynamic factor (f) = Level/field 2L : level/field 1

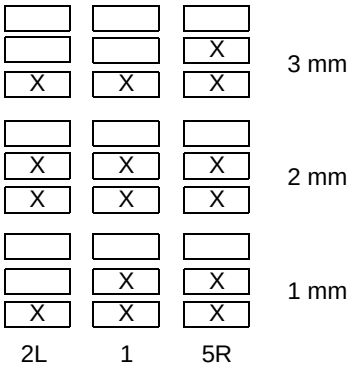


Field No.	B signal (mV) Input C.C.U. (without bias light)	BA signal (mV) Output C.C.U.
1	80 ± 15 mV	350 ± 50 mV
5R	no limiting	

Capillary test

I.I. formats 22 cm, 23 cm, 27 cm, 28 cm

Capillary test (37 90 180)



The marked capillaries **do not** have to be visible

Resolution and minimum contrast of the I.I.-TV system (interl. - Bypass)

1.2 mm Cu filter; test pattern (type 41) 45°; 17 µm Cu strip; approx. 70 kV

I.I. Type:	40 HDR - IS
Full format	1.0
Zoom 1	1.4
Zoom 2	1.8
Zoom 3	2.0

The minimum contrast must be always visible.

Image artifacts

Refer to the measuring instructions for a description of artifacts.

Digital Fluoro Radiography / DFR

FLUOROSPOT H

Values apply for 50Hz and 60Hz versions.

Dose/pulse at the I.I. input

2.1 mm Cu filter, X-ray tube voltage 70 kV

I.I. Format (cm)	Dose 50 (nGy/F)	Dose 100 (nGy/F)	Dose 200 (nGy/F)	Dose 500 (nGy/F)	Zoom-Dose-Factors PLSX ***2**	PLSX65/80
40 HDR - IS	215	435	870	2175	0.5:	0.50:
28	400	800	1600	4000	1.0:	0.92:
20	790	1580	3160	7900	2.0:	1.81:
14	1090	2175	4350	10900	2.5	2.50

$U_{Multiplier} \geq 450$ V ***1**

1 nGy = 0.115 µR / 1 µR = 8.7 nGy

***1** effective as of 07/93 (with masked Multiplier only)

Tolerance ± 15% (DSA-Dose 500 + 15% / – 20%)

At indirect dose measurement: tolerance ± 15% of the mAs value.

Tolerance for reproducibility at DSA (8/F/s; Dose 500): $\Delta \leq 20\%$ of average

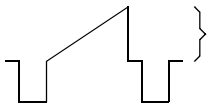
Amplification of DFR system

Cut off pedestal

ADC-DAC function at DR

remaining pedestal	
DR	from W1/W2 = 259/258 to W1/W2 = 263/262

ADC-DAC function at DR

- Input DFR:  = 1100 mV ± 10 mV
- trigger DR exposure (SS OFF)
  upper window level = W1 = 511
- check on TV monitor:

VIDEOMED H1X

bone black
white pixels disappear at lower window level = W2 = 498 – 510

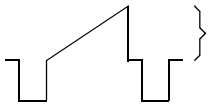
bone white
black pixels disappear at lower window level = W2 = 498 – 510

VIDEOMED SX / H1X Emulation

bone black
white pixels disappear at lower window level: 60Hz: W2 = 498 – 510
50Hz: W2 = 488 – 500

bone white
black pixels disappear at lower window level: 60Hz: W2 = 498 – 510
50Hz: W2 = 488 – 500

ADC-DAC function at DSA

- Input DFR:  = 730 mV ± 10 mV to VC10
  1100 mV ± 10 mV from VC20

- Release DR exposure (assess native image)
  upper window level = W1 = 511

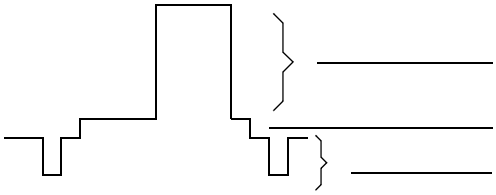
- Check on TV monitor:

bone black
white pixels disappear at lower window level: 60Hz: W2 = 498 – 510
50Hz: W2 = 488 – 500

bone white
black pixels disappear at lower window level: 60Hz: W2 = 498 – 510
50Hz: W2 = 488 – 500

DAC output amplifier

- use DR exposure (see)
- upper window level 381; lower window level 380
  output signal DFR



Monitor adjustment

Luminance white(100%)	260 ± 20 cd
Luminance black(0%)	0.8 ± 0.1 cd/m^2

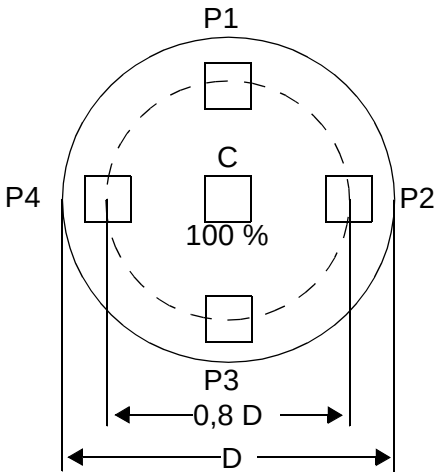
5% field (5% and 95%) must be visible.

BA signal values / Adjustment of iris diaphragm in DR mode

Mode	BA signal (mV); Output DFR	
	VIDEOMED H1X	VIDEOMED SX
LIH	200 ± 20	220 ± 35
DR Single, Dose 100	225 ± 15 ◄ Basic setting	
DR Single, Dose 50/200 DR Serie<6F/s, Dose 50/100/200	225 ± 35	
DR Series 6F/s, Dose 50/100/200	225/ +50/ – 25	

Vignetting with DFR

at I.I. full format



$$\Delta 1 = \left|\frac{P1 - C}{C}\right| \times 100 \leq 35\ \%$$

$$\Delta 2 = \left|\frac{P2 - C}{C}\right| \times 100 \leq 35\ \%$$

$$\Delta 3 = \left|\frac{P3 - C}{C}\right| \times 100 \leq 35\ \%$$

$$\Delta 4 = \left|\frac{P4 - C}{C}\right| \times 100 \leq 35\ \%$$

$$\Delta 5 = \left|\frac{P1 - P3}{C}\right| \times 100 \leq 35\ \%$$

$$\Delta 6 = \left|\frac{P2 - P4}{C}\right| \times 100 \leq 35\ \%$$

Dynamic test

I.I. format 22/23/27/28 cm

Amplitudes / Adjustment of iris diaphragm for DSA mode

Tolerances apply as of software version VC20.

VIDEOMED H1X

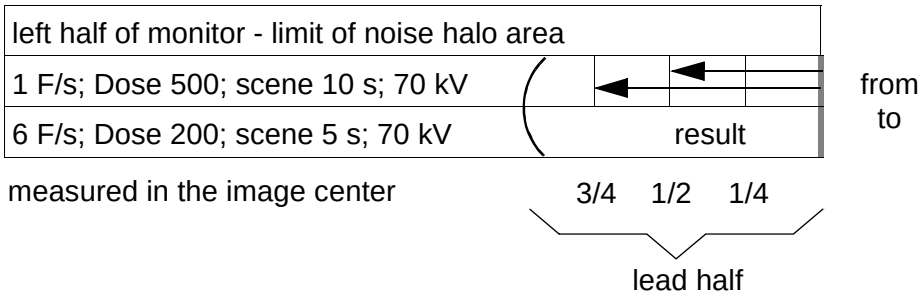
U_a = 70 kV	**BA signal [mV]; Output DFR**			
Field No.	**LIH** 1	**DR** Dose = 100 Single	**DSA (Nativ)** Dose = 500 F/s = 1 Scene= 10 s	**DSA (Nativ)** Dose = 200 F/s = 6 Scene= 5 s
2L	≥ 350	570 ± 50	< 650 ***1**	< 650 ***1**
1	200 ± 20	225 ± 25	225 ± 35	225 ± 35
5R	no limiting			

VIDEOMED SX / H1X Emulation

U_a = 70 kV	**BA signal [mV]; Output DFR**			
Field No.	**LIH** 1	**DR** Dose = 100 Single	**DSA (Nativ)** Dose = 500 F/s = 1 Scene= 10 s	**DSA (Nativ)** Dose = 200 F/s = 6 Scene= 5 s
2L	≥ 350	570 ± 50	< 650 ***1**	< 650 ***1**
1	240 ± 20	225 ± 25	225 ± 35	225 ± 35
5R	no limiting			

***1** If the 2L field were > 650 mV, then < 190 mV would be acceptable for field 1.

Black level cutoff (noise halo)



Resolution

1.2 mm Cu filter, test pattern (type 41) 45°; 17 µm Cu-Strips; 70 kV

minimum resolution (LP/mm)

BV-/ I.I. Format,cm	Bypass ***1**	Dig. Fluoro	LIH	Super-vision	Digital exposure	DSA (Nativ)	HCC ***2**
40 HDR - IS	0.9	0.9	0.8	0.9	0.9	0.9	0.9
28	1.2	1.2	1.0	1.2	1.2	1.2	1.2
20	1.6	1.6	1.4	1.6	1.6	1.6	1.6
14	2.0	2.0	1.8	2.0	2.2	2.2	2.2

DR, DSA (native): W1 = 511; W2 = 256; E% = 0, Dose 100
DL: W1 = 511; W2 = 256; E% = 0; temp. filt = 6%

***1** ☼ + ◑ adjusted and blocked

***2** The resolution of the hardcopy camera must not limit the DFR resolution.

Minimum contrast

The minimum contrast must always be visible.
Test conditions are the same as for resolution.

Checking the DSA equipment

I.I. format = ☐ 22cm; ☐ 23cm; ☐ 27cm; ☐ 28cm

Window level DSA image: Brightness W1 = 80; Contrast W2 = 220

- with grid
- E (%) = 0
- Dynamic test with heart contour diaphragm and capillary test no.37 90 180

		1 frame/sec.; dose = 500 scene= 10 s ; 70 kV						6 frames/sec.; dose = 200 scene= 5 s ; 70 kV					
		Test field						Test field					
		2L		1		5R		2L		1		5R	
		***1** Contrast sensitivity											
3 mm	16 %												
	4 %												
	0.75 %	X	X	X	X	X	X	X	X	X	X	X	X
2 mm	10 %												
	3 %												
	2 %											X	X
1 mm	7.5 %												
	4 %												
	2.5 %		X						X			X	X
		***2** LOG amplifier											
3 mm	16 %		n+2 -1		n		n-3		n+2 -1		n		n-3
		***3** Subtraction											
		0 ± 1		0 ± 1		0 ± 1		0 ± 1		0 ± 1		0 ± 1	

***1** The capillaries marked do not have to be visible.

***2** Tolerances are for Software version VC20 only; no tolerances for VC10 version.

***3** Basic grey level of test field

x = capillary test no. 97 50 019

o = new Iodine capillary test no. 37 90 180

Image artifacts

Refer to the measurement protocol for a description of the artifacts.

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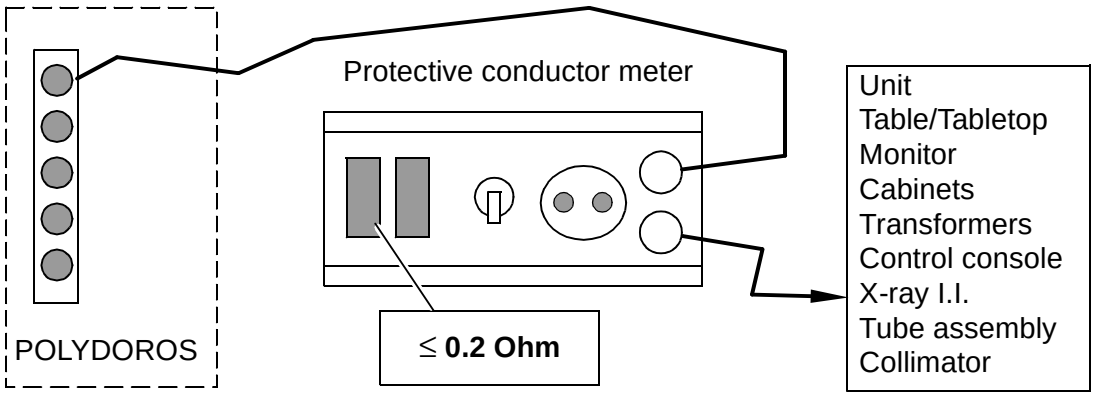
Final work

- Sign the completed IQ test certificate and the general UROSKOP D3 test certificate.
- If necessary, perform the acceptance test according to RöV §16 or DHHS regulations, respectively.
  If the settings made at the factory have not changed, the values can be transferred from the test certificate.
- Remove the washer (adjustment aid) that was affixed to the grid as a center marker.
- Switch the system off.
- Disconnect the service PC from the system.
- Reattach all covers and cabinet side panels, with the exception of the generator front panel.
  (Refer to Installation Instructions RLL5-310.031.03..).
- Repair any paint chips or defects.
- Clean the system.



Measuring the protective conductor resistance

Measuring device: Protective conductor meter

Measured value: **max. 0.2 Ohm** (Observe the country-specific regulations)
(current 10 A, voltage drop: max. 2 V)

Measuring procedure: Measure all conductive system parts within reach as well as the grounding bus in the generator.
(Exceptions: accessory bars and tabletop).

Conditions: **Protective conductor resistance, max. 0.2 Ohm**

- If greater, increase the gauge of the protective conductor.
- Reduce the contact resistance (e.g. tighten screws).
- Close the generator cabinet panel.

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Chapter	0 up to 11	Templates changed
Chapter	0:	Revision level changed
Chapter	9:	Expanded to add FLUOROSPOT H with Supervision
Chapter	10:	Expanded to add FLOUROSPOT H with Supervision
	10 - 1	Table changed
	10 - 2	Table changed
	10 - 6	Table changed
	10 - 10	Table changed
Chapter	12:	New

TD PS 24 / Erlwein

TD SP / Heinlein

SMS Iselin

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